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MEMORANDUM FOR: Dr. Harold M. Schoolman, Acting Director, NLM
Mr. Kent A. Smith, Deputy Director, NLM

SUBJECT: Notification of Completion of First Chapter of Book

At long last, I am able to inform you that I have completed the first chapter of my book on the history of Federal STI since World War II.

It has taken considerably longer than I expected, but this is because I felt that the contents had to show careful research and preparation. In a discussion with Dr. Cummings, he agreed that this was the best course of action and that I should not be concerned with the dates originally agreed upon. A count of the pages reveals a total of 295 double-spaced pages. This is almost the size of a single book.

Much of the contents is devoted to three sections. The section dealing with the role of Congress contains 80 pages. The section covering key studies and reports is the longest; 120 pages. I have told the story of how U.S. scientists were involved (and vice versa) in science communications in 21 pages. The other 14 sections are much shorter, the longest one being nine pages. It is quite probable that some of the material in the longer sections will appear in the later chapters and reduce the amount of work required. Possibly, I will re-jigger the outline of subsequent chapters to reduce the size of the book. At this stage of writing, however, I plan to proceed as originally planned.

In the first chapter I have set the stage for the following chapters, especially the last one, which will feature what I believe needs to be done in the future. It will be a plea that we really respond to the challenge and the opportunities to create a Federal and national information system equal to the current and future needs.

Of course, the first chapter will need some polishing, although I have written it as though it was ready to go to the printer with the addition of sub-titles. If you like, we can have the 290 pages copied and filed. Alternatively, I can bring the manuscript up for your inspection. I guesss you can also take my word that the first chapter is done. Any of these courses of action are satisfactory to me.

I hope this memorandum of accomplishment will make it possible for me to receive the first installment called for by the contract. Aside from time and other costs, I figure that I have travelled close to 5,000 miles, perhaps more, since the beginning of 1983, coming to and from NLM. The fact that I am enjoying what I am doing and I like the people in Lister Hill and NLM is a form of compensation that I appreciate.

Please let me know what next steps I should take; in the meantime, I am starting Chapter Two, gentlemen.

Sincerely yours,

Consultant

CHAPTER ONE

A POST-WORLD WAR II HISTORY

1.1. A Legacy of Science Communications

To believe that science communications is a new development is to misread reality; it is as old as recorded history. Wherever there are written annals of the past, there are accounts of natural and often supernatural phenomena. The Bible and other holy books, cave drawings, Egyptian hieroglyphics, medieval treatises, early cartography - these are or contain examples of early scientific and technical communication. The arrival of the Rennaissance and the Industrial Revolution, stimulated by the invention of the movable-type printing press, brought a small explosion of scientific and technical writings and the beginning of the so called "information explosion," a process which continues unabated into the present. From time to time, we have to remind ourselves that the appearance of this kind of literature preceded the recognition of the field of science and the existence of scientists as a community of distinction.

Science communication, based upon observation, identification, description, expermental investigation, and the theoretical explanation of natural phenomena, received its impetus during the 17th century with the appearance and growth of the learned scientific societies in Europe, such as the British Royal Society. From this point on, scientific communication included factual, systematic, objective and methodological knowledge. This is not to say that there is not a stratum of quasi-science literature that receives wide dissemination. Some unkind critics are wont to complain that much of what passes as first order science information hardly merits such a label. There is no need to argue the point. Suffice it to say that quasi-scientific literature generated in the past, as well as today, provides a large penumbra that contributes heavily to the information proliferation so marked in the literature.

Similarly, that penumbra is widened considerably with the inclusion of information

(1.1 continued)

that applies to the application of science to industrial, commercial and military purposes. It is increaingly difficult to separate scientific information from technological or technical information. This was fully understood by the members of the early scientific societies, whose discoveries were made possible by the invention of optical and other sensing technology that made possible observations and measuring so necessary to disciplined science.

The importance of science communications in the eyes of scientists hardly needs any comment. From the time they are weaned into the mores of their profession scientists recognize their debt to their predecessors who built up the ediface of knowledge upon which they depend and to which they contribute during their years of productivity. Though normally a peacefully inclined community, abhoring the frictions and noises of the work-a-day marketplace, they are ready to go to battle when there is an outside threat to their precious science communication structure. Nor do they remain silent when one of their members seeks to circumvent the system and publish less than accurate research findings. In recent years, there have been several incidents reported in scientific publications, such as Science (U.S.) and the New Scientist (U.K.). Invariably, there is a demand for sanctions against the perpetrators of frauds and usually careers are blemished and often ended. It should be pointed out that spotlight is turned on individual actions rather than on the overall science communication mechanism. This will be discussed later in this chapter.

1.2 "Big" Science Arrives on the Scene

With few exceptions, here and there, up to World War II, science was a modest operation with a small budget and a small population. It was largely conducted at universities and industrial laboratories. While many governments contributed to science and technology in earlier years, their support was far from impressive. Their own laboratories were small and their focus was on purely mission accomplishment and enhancement, such as developing new weapons, weather forecasting, and maintenance of health. Much of the work was farmed out to the private sector, even by the in-house arsenals and laboratories in the United States. On the whole, under such circumstances, scientific and techological communications were only of passing interest to the U.S. and other governments. Only marginally was the U.S. government involved in international scientific and technical information exchange. The Executive Office of the President had little interest in such matters. Federal agencies were involved to a greater extent in specific areas, but these dealt largely with security, treaties, weather, electronic spectra allocations, control of disease, and terrestrial exploration. For the most part, except during program and budget hearings, Congressional committees paid little attention to science and technology. Few senators and congressmen came from the world of science and technology, hence, interest was marginal on the part of the Legislative Branch.

Came World War II and and some years later the flight of the first Soviet Sputnik and there was a dramatic change. What has been called "Big Science" came to the United States. More accurately, it was largely a technological explosion paced by scientific midwifery. The fuel was a mixture of deep concern at the highest levels of government, money, and a rapid increase of scientists, engineers, technical workers, industry - a new and potent government/industry/academe establishment devoted to creating and exploiting new knowledge in the public interest. The United States became the so-called "Arsenal of Democracy." It turned out the goods of war for the Allied cause, and in the process, became the greatest technological power in the world. That the Soviets were the first to launch a "beeping" vehicle in

space became a sore and vexing point to the government and the science and technology establishment of the United States. Volumes have been written on this subject and there is no need to repeat what has been written elsewhere. What needs to be stressed is the size of the build-up, the deep involvement of the Federal government, thus the citizens, the huge investment that was made in science and technology, the rapid development of the national structure of science and technology and its general acceptance by the populace. It was obvious that governmental indifference had given way to full involvement by the Federal government in the process. A considerable corps of scientists, engineers and research and development managers came into being. Congressional committees and their staffs were built up to participate and monitor the large Federal programs. Large and complex budget matters brought a different mix to the personnel of Congress, calling for the inclusion of resident scientists and engineers to assist the Congressional committees.

The increase in volume of scientific and technical information was recognized by the scientific societies which maintained a publication program earlier, perhaps, than the Federal government. The unique system of technical publications created by the publishing world, such as Iron Age, Electronics and similar products grew as the science and technology establishment expanded in the late 1940s, as well as in the 1950s and 1960s. They featured "unpublished literature," i.e. reports and papers that were not subjected to the refereeing process employed by the scientific journals. During the earlier years, government scientists, engineers and research and development managers were so busy "doing" science and technology that they paid little attention to the increase of technical reports and other documentation that were the products of the growing Federal research and development programs.

1.3 The Proliferation of Scientific and Technical Information and Data

The output of new scientific and technical information in the United States was nothing short of phenomenal. During the 1960s, it was contributing something like 35 to 40 percent to the world's output of scientific information, according to Professor Anderla.[1] Long before Anderla came on the scene, Dr. Derek de Solla Price, Avalon Professor of History of Science at Yale University, addressed the subject of proliferation in his Little Science, Big Science book. He pointed out then that science literature was doubling, had been doubling for many years, every decade [2] Dr. Price was concentrating on the articles that appeared in scientific journals, rather than on "unpublished" articles and papers in technical journals and in government reports. No accurate data were available about the proliferation of the latter types, where the rate of increase was probably greater. During the 1960s, the National Technical Information Service and its predecessors were receiving about 100,000 scientific and technical reports from the Federal R&D agencies. Since Federal R&D funds have not decreased greatly in recent years, it can be assumed that the Federal output of technical reports is still substantial. It is not usually publicized that the output of some of the Federal agencies are not transferred to the National Technical Information Service, but it is a fact that a significant portion of the scientific and technical information produced by Federal agencies are not made publicly available. For example, some laboratories produce technical notes that are in every way as information-laden, some more so, than the technical reports they produce. Many valuable studies, analyses, test reports, and the like, are being generated to add to the proliferation. Technical data are generated, as well, that rarely gets into the scientific and technical information stream. Some are made available through Federally-supported information analysis centers, but it is believed that these data are only a small part of the data that

1. Anderla, Georges J., The Growth of Scientific and Technical Information-A Challenge, National Science Foundation, Washington, D.C., January 1974

2. Price, Derek de Solla, Little Science, Big Science, Yale University Press, New New Haven, 1961

produced. Since a large part of the Federal research and development is done by contractors outside of the government, there is no certainty that their information products are fully reported. Some are, of course, but much of the knowledge is withheld from public dissemination.

In recent years, the electronic media have vigorously undertaken dissemination of scientific and technical information for their users and viewers. Since television has an omniverous appetite for the new and the different, it has been digging deeper and deeper into the findings of the scientists and engineers and reporting them somewhat less technically for public consumption. The audience for TV's NOVA and other successful science-oriented programs has been increasing, making the annals of science and technology a new hunting ground for a widening audience. Reporting on the flora and fauna of the world by organizations such as the National Geographic Society is common fare on television, public and commercial. As TV audiences become more sophisticated by watching such programs, it is evident that such programming will continue and probably expand, thus increasing the proliferation of scientific and technical information. Health information has also been disseminated in increasing quantities by the health community in and out of the Federal government. The interest of the public in new medical information is paralleling the availability of such information to the health profession. Major contributors to this phenomenon are the National Library of Medicine and the National Institutes of Health, which are dedicated to improve the flow of medical information and the productivity of the health community.

As the world increases its output of scientific and technical information, a process that has been underway for a number of years, it is quite possible that the doubling of scientific literature reported by Price will increase, although not dramatically. Even if the same pace is maintained, the proliferation will be considerable, taxing the conduits of dissemination severely.

1.4 Information Technology Arrives with Hurricane Force

The Information Explosion was a constant source of worry during the 1960s for information handlers and users. It was constantly being discussed at symposia and conferences. In light of the evident proliferation of information and data, how would it be possible to cope with the flood? What steps needed to be taken to "control" the literature, i.e., finding specific documents or packets of information and providing an orderly catalog that would permit librarians and other tenders of the information store to file and retrieve rapidly and effectively? Much of the literature of that time dealt with the efforts of the documentalists to work out schemes of indexing and other devices to bring order and transparency to the growing knowledge resource. Central to virtually all of the techniques developed was the computer, which was recognized as an extraordinary boon, a marvelous tool that would, properly harnessed and used, contribute to the solution of control.

The proliferation was most acutely felt by large university and public libraries, where expansion of holdings was taxing their facilities, large as they were. With this concern as a backdrop, Project Intrex was undertaken by the Massachusetts Institute of Technology under the leadership of Professor Carl F.J. Overhage. A Planning Conference was undertaken to lay out guidelines. The Planning Group was made up of illustrious scientists and engineers: Ithiel de Sola Pool (MIT), Nathaniel Rochester (IBM), Jesse Shera (Western Reserve University), Samuel S. Snyder (Library of Congress), Fred A. Tate (Chemical Abstract Service), John W. Tukey (Princeton University), Claude Walston (IBM), I.A. Warheit (IBM), and F. Karl Willenbrock (Harvard University). The Planning Conference recognized three main streams of programs in the information transfer field: (a) the modernization of current library procedures through the application of technical advances in data processing, textual storage and reproduction. (b) The growth, largely under Federal sponsorship, of a national network of libraries and other information centers. And (c) the extension of the rapidly developing technology of on-line, interactive computer communities into the domains of the library and other information centers. It was observed

1.4 continued

that "the university information transfer system of the next decade will result from a confluence of these three streams. Rapid advances in information transfer by on-line computer systems will greatly extend the scope of information services in the academic community, but only if they are supported by the resources of a modernized university library and by integration with coordinated networks of local and national resources." The planners called for a core program to include a "model library", mechanization of current procedures, an augmented catalog experiment, a text access experiment, and a network integration experiment. The purpose of the last was to promote the integration of university libraries into the national (and, ultimately, international) network of information centers. The planners also suggested a major experiment on the interaction of a computer-based university information transfer system with the informational resources of such organizations as the National Library of Medicine and the National Aeronautics and Space Administration.[3] Similar programs and experiments were undertaken at other universities to harness the new information technology to their needs. It should be recognized that several Federal agencies assisted these efforts with grants and other resources.

But the advent of new information technology was not confined to the computer as it passed through various generations of proficiency. The development of the photocopier and its capability of "making every man a publisher" had quite an impact on the information field. Bcause it brought with it problems dealing with the fair or unfair use of intellectual property, the impact of the photocopier was probably felt earlier than the emerging computer. This topic will be more fully discussed in the history of the Committee on Scientific and Technical Information (COSATI). The advent of communication satellites and newer developments in micrography was of overwhelming significance as the armamentarium of storage, retrieval and delivery systems began to increase and diffuse.

3. Carl F.K. Overhage and R. Joyce Harman, Intrex Report of a Planning Conference on Information Transfer Experiments, MIT Press, September 3, 1965

(1.4 continued)

The insights of the writers of a Report to the President of the United States, National Information Policy, on the subject of the "Impact of Technology" are insightful.

> "The advent of computer and communications technology is causing a quiet revolution to occur in the field of information. It is quiet because the signs of change are subtle and not always visible. It is a revolution because the rate of change is very rapid. Our country now possesses new information technology that can retrieve and distribute information faster, with greater facility, to more people than ever before in history... The consequences of this newly emerging information environment are poorly understood analytically, but they are destined to have an enormous impact on the Nation's economic growth, our social development, and our individual lives. How information is handled in this country determines, to a large extent, the the quality of the decisions which our people must make. Government must, therefore, be alert to the dynamics of change that are taking place."[1]

Amplifying on the key characteristics of the new information environment created by information technology, the Report lists these as follows:

> An exponential increase in the volume of information flow. Critical observers expect a fourfold to sevenfold increase by the year 1985.
>
> A shrinkage of time and distance constraints upon communications. Satellite communications provide long distance capability to use computers and other information technology throughout the world.
>
> Greater nationwide dependence upon information and communication services. There are already nearly one million computer terminals in the United States which provide interactive, on line information services to people across country.
>
> An increase in the interdependence of previously autonomous institutions and services. An example is the linking of libraries and information centers into networks designed to share resources across traditional jurisdictional lines.
>
> Conceptual changes in economic, social and political processes induced by increased information and communications. The projected impact of a "checkless/cashless" society is a prime example.
>
> A decrease in the "time cushion" between social and technical changes and their impact and consequences.
>
> Global shrinkage and its consequent pressures on increased international information exchange.[2]

[1] National Information Policy, Report to the President of the United States, submitted by the Staff of the Domestic Council Committee on the Right of Privacy, Washington, D.C., July 19, 1976, pages 3 and 4

[2] Ibid, pages 5 and 6

(1.4 continued)

The Report's call on "Government to be alert to the dynamics of change that are taking place" has fallen on deaf ears when it comes to the field of scientific and technical information, this in the face of the increasing worldwide awareness of the importance of scientific and technical information. With the exception of the National Library of Medicine, virtually all of the Federal agencies have abandoned their once substantial programs to advance their missions. There will be more on this subject in other chapters. But it is hardly short of a national disgrace to recognize that there is no major program or office at the Executive Office of the President level organized to track the information technology revolution, analyze its current and future impact on governance, and provide plans to apply the technology to national needs, as well as recommendations to cushion its impact on the citizenry and their institutions.

1.5 Congress Discovers Scientific and Technical Information

It would be fallacious to assert that Congress has recently learned about scientific and technical information and its importance. The truth of the matter is: scientific and technical information are important, always have been important, to Congress in its role of lawmaking. It is equally true that "increasingly, the lawmaking function has been taking on a scientific content, (hence) the necessity has accordingly arisen for Members of Congress to participate in many decisions relating to science." This point is made in a Report to the Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, Technical Information for Congress, April 25, 1969. The Report points out:

> "The vocabulary of science is elaborate and specialized, but objective and factual; that of politics is more everyday, and is centered on value judgements. The rules of science data differ from the rules of legal evidence: scientific truth is established by objective demonstration and confirmed by replication; political truth is established by consensual agreement, usually after an "adversary" contest. Science deals with its subject matter in mainly quantitative terms.
> The subject matter of scientific issues is foreign to the experience of political decisionmakers; few scientists join the ranks of the political decisionmakers, and few political decisionmakers can accept the product of scientific analysis as unqualified guidance in making political decisions.[2]

Not only does Congress recognize the differences between the two "cultures" in the way of communication from the scientist to the politician relative to public issues with scientific content, such differences as rules of validation, quantification, subject-matter and vocabulary; it also recognizes a social phenomenon "classically" known as the "Egyptian priesthood", explained as follows:

> "Under the Pharaohs, the Egyptian priests had special knowledge of geometry, which enabled them to control the distribution of lands. They had special knowledge of the mysteries of nature, and special vocabularies in which to express their findings. By this exclusive knowledge they were able to control and influence the administration of the government. Their judgements were unchallenged because only their associates in the temples knew the language; the loyalty of the cult preserved their solid front. In a sense, the Pharaohs had the same problem as the Congress of today..."[3]

1. Technical Information for Congress, Report to the Subcommittee on Science, Research, and Development House Committee on Science and Astronautics, Science Policy Research Division, Library of Congress, April 25, 1969, page 1
2. Ibid, page 5
3. Ibid, page 12

Having made this point - the primary interest of Congress in scientific and technical information derives from its need to legislate wisely - it is also true that it has maintained an interest in the effectiveness of Federal scientific and technical information programs that exceeds that of the Executive Branch research and development leaders. How this came to be is a fascinating footnote to U.S. history in science and technology.

It would be logical to expect that a scientist or scientists would have provided the kind of leadership that resulted in the major, world-class scientific and technical information systems that were established in the early 1960s by the Federal research and development agencies. The reality was that it was a member of Congress, Senator Hubert H. Humphrey. Adkinson writes of this genesis:

> "The Senate Subcommittee on Reorganization and Internal Organization of the Senate Committee on Government Operations held a series of hearings during 1959 and 1960. The Subcommittee, chaired by Senator Hubert H. Humphrey, issued a report entitled Documentation, Indexing and Retrieval of Scientific Information. The Subcommittee did not draft legislation, but Senator Humphrey interrogated representatives from the private sector, heads of federal libraries and information centers, directors of R&D programs, and experts in the technologies related to library and information sciences. His major contribution was to insist that responsible government officials report back to the Subcommittee on steps they were taking to improve the sci-tech information activities within their agencies and departments. Senator Humphrey's reporting requirement made many of the heads of R&D agencies aware for the first time of the problems in the information field and called to their attention some of the weaknesses in their agency's information activities." [1]

It was a virtuoso performance, skillfully accomplished by a master politician with the help of his senior aide, Julius Cahn. Why was the Senator so adament, so insistent that the Federal agencies establish modern scientific and technical information programs? Did he sense the arrival of the Information Age, the explosion of new and powerful information technology and the need to take early steps to improve the

[1] Adkinson, Burton W., Two Centuries of Federal Information, Dowden, Hutchinson & Ross, Stroudsburg, Pennsylvania, 1978

capability of the Federal government? Of course, but reading what went on at the hearings he held, one comes away with an additional motive. The Senator was conscious of the shift from "Small Science to Big Science." He was conscious of the huge investment by the Federal agencies. Fearing duplication and overlap in R&D projects, he saw the need to prevent it through a system of information interchange among the agencies, so that each knew what R&D work was going on in the other agencies. No such system existed at that time.

On Friday, September 21, 1962, the Subcommittee on Reorganization and International Organizations of the Committee on Government Operations met early in the m orning in the New Senate Office Building. Senator Humphrey, its chairman, presided. After a few preliminary remarks, he said:

> "The reason we are here this norning is in order to strengthen the $12 billion worth of Federal science and engineering programs. I shall be very frank about this. Despite a certain amount of progress, the present situation can be termed anything but satisfactory. I would say there is tragic confusion insofar as management of Federal information programs is concerned.
>
> There are some good information systems within the Federal Government today. Many improvements have been made in recent years in these systems. The improvements are not, however, sufficient. They are usually too limited and marginal in effect. The Federal agencies are still so choked up with innumerable documents - monographs, research papers, administrative reports, etc. - that nobody knows where they are, what you are supposed to do with them, how they got there.
>
> If the agencies think they are going to do this and continue it this way, it can be branded only as a colossal waste of public funds. There is no excuse for it. I have been at this information job now for almost 6 years and that is why we are having this hearing.
>
> One of our purposes... is to get into the new Federal budget specific monies for improved information programs, not just for more research projects, not just for more missiles, not just for more studies by the National Institutes of Health or the Atomic Energy Commission.
>
> I think, however, it is about time that the public comes to know what you have been doing with the money. The public should know what happens in terms of the kind of information structure that has been put together so that information is made usable and available (where it is not classified). And, as to scientific research itself, the public is entitled to assurance that there is not duplication of effort and a waste of public funds...

> I am on the Appropriations Committee, and I am holding this particular meeting because, in all candor, I am displeased with what is being done. The agencies are putting their money in only the most tangible items such as research projects; they are not putting adequate money into library and information services. This matter of balanced allocations happens to be one of the subjects that is very close to my heart, as you can see, and I must say I am disturbed, distraught, disgusted over the failure to get things done...
>
> The grand total of agency systems represents an unbelievably jumbled mass of structures. I would say it is almost a "Tower of Babel." It is a patchwork. The agency systems overlap. They duplicate; they omit; they are slow; they are often little used by those who need them most. With few exceptions I would say we have a 19th century information system for a New Frontier administration." [1]

The message was delivered to an assemblage of the leaders of Federal agencies and the managers of their research and development programs. It was unique in the annals of government. It was heard and action resulted.

We are indebted to Julius Cahn, President of Family Media Enterprises, Inc., for writing about Senator Humphrey after the latter's death. Here are a few excerpts from his paper.

> "Hubert H. Humphrey was the U.S. Congress'champion of information science - its greatest enthusiast, its foremost spokesman. As far back as 1958, he said: "A new age of science has dawned, and it is an Information Age. A new industry has been born - the knowledge industry...Scientific information is of little good unless it is properly used. Let's put information to work. Let's evaluate it for quality. Let's abstract and index it. Let's get it out to those who need it - promptly and conveniently." He was always user-oriented; he wanted the Federal government to blaze the trail in service to scientists and engineers everywhere. As his responsiblities grew over the years, it was not possible for him to give the information field as much of his attention. But later, even as a busy Vice President, wherever opportunity permitted, he returned to one of his favorite themes: "Information is power! Let's use the power well." He wanted a global network of information clearinghouses, an international system of systems. " [2]

1. Interagency Coordination of Information, Hearings before the Subcommittee on Reorganization and International Organizations, Committee on Government Operations, U.S. Senate, 87th Congress, September 21, 1962, page 2-4 (excerpts)

2. Cahn Julius, Hubert H. Humphrey: Champion of Information Science - Some Reminiscences, Bulletin of the American Society for Information Science, Vol.4, No. 3 (February) 1978, pp 19-21

(1.5 continued)

From Cahn's reminiscences, we learn about a contribution made by Senator Humphrey in late 1958 that has not received wide attention. Cahn accompanied Senator Humphrey on a whirlwind trip to Europe, where the latter preached the new gospel of information science and sought to raise the consciousness of all those with whom he came in contact - scientists, national and international leaders. Humphrey urged information programs, not as ends in themselves,but as ways to solve mainstream problems. Cahn states: "In effect, he told people in the "trenches" that information would help win battles being fought, whether it is cancer, Asian flu, or the birth of deformed children." [1] Not only did Humphrey meet with scientists and other leaders of the Pasteur Institute, Excerpta Medica Foundation, World Health Organization, Karolinska Institute, and other European capitals, he went on to Moscow and met with Soviet Premier/Chairman of the Council of Ministers, Nikita Khrushchev, who told him of "a new 8700-mile Soviet ballistic missile which "could hit a fly from outer space" as a message to President Eisenhower.

There is so much more that can be said about the contribution of Senator Humphrey to the world of science and science communications, but suffice it for the purposes of this treatise to acknowledge his special niche in the history of information science.

In 1963 and 1964, the newly formed Select Group on Government Research chose scientific and technical information as an area to investigate. It was one of 10 fields in research and development to be studied. An Advisory Panel on Documentation and Dissemination was formed, made up of Philip H. Abelson, Editor of Science, R.G. Chollar, Vice President of National Cash Register Co., Leland G. Cole,Vice President, Whittaker Corp., Michael Demarest, Senior Editor, Time, Inc., Herman Fussler, Director of the Uiversity of Chicago Libraries, Jacob E. Goldman, Director of Ford Motor Co. Scientific Laboratory, William T. Knox, Manager Corporate Planning, Esso Research and Engineering, Max S. Peters,Dean of Engineering, University of Colorado, Kenneth S. Pitzer, President, Rice University, Eugene A Stead, Profess-

(1.5) continued)

or of Medicine, Duke University, and Myron Tribus, Dean, Thayer School of Engineering, Dartmouth College. William T. Knox, whose name will figure prominently in this paper, resigned from Esso Research on October 1, 1964 to become Technical Assistant, Office of Science and Technology, Executive Office of the President. The Select Committee was chaired by Representative Carl Elliott of Alabama.

On November 20, 1964, the Select Committee sent the Speaker of the House, John W. McCormack, Study Number IV, Documentation and Dissemination of Research and Development Results,[1] the product of two years of work. The expressed concern of the Select Group was for the diligent and successful performance of scientific and technological research and development for the survival and healthy growth of the Nation. The Report states:

> "This study by the Select Committee on Government Research will deal with Federal scientific and technical information programs, their efforts to achieve efficacy and timeliness, their present scope, prevailing practices access to and utilization of foreign information, problems that face them, and proposals for dealing with them."[2]

The Report concluded that:

> (1) There may be more information generated than can be effectively handled...The more widely it is dispersed, the harder to find. This work ought to be made easier for the scientist.
> (2) The present situation invites waste and inefficiency...There is unwillingness by some of those who administer the program to cooperate if cooperation involves surrender of any autonomy.
> (3) Some "stocktaking has begun, Scientific and Technical Information has emerged as a separate "line item" in the budgets of major R&D agencies. Apart from the congressional committees which have been examining the area from various viewpoints, executive and independent agencies have been looking over the same ground. And here we have seen indications of duplication and waste. Studies seem to be launched which appear to ignore other studies underway or already completed by other departments or agencies - sometimes even by other offices in the same department.[3]

Reflection on these three conclusions eighteen years after the Report was issued reveals that the problem of proliferation of information continues; the lack of

1 U.S. Congress, House. Select Committee on Government Research, Documentation and Dissemination of Research and Development Results, U.S. Govt. Print, 1964, 148 p.

2 Ibid, page 2.

3 Ibid, page 89.

(1.5 continued)

willingness to cooperate on the part of those responsible for scientific and technical information programs continues; "separate" line items for scientific and technical information programs never really caught hold; the proliferation of studies of Federal and national scientific and technical information of the type undertaken in the 1960s diminished and disappeared with the passage of time.

The recommendations made in the Elliott Report are summarized as following:

> Most importantly, a coordinated effort is required to attack the problem with a determination that the solutions proposed will involve concentration of responsibility and authority.
>
> The White House Office of Science and Technology should be responsible for implementing COSATI recommendations, if the latter is unable to do so. COSATI's enforcement authority is questionable.
>
> COSATI should prepare a master plan for coordination of all Federal information facilities. Federal agencies provided a partial list of facilities, 259 of them. Some agencies did not include their technical libraries to make the list more accurate. A study is needed to determine existence, need and the possibility of proliferation without reason.
>
> COSATI should continue its initiative in refining glossaries and coordinating thesauri, also the standardization of systems and formats. This should be extended to include standardization of accounting methods and terms, as well as more precise evaluation of costs of information programs.
>
> One single clearinghouse should be designated that coordinates all foreign activities of the Federal agencies in the efficient documentation and dissemination of technological information originating abroad. The Office of Science and Technology should determine where the function should be centralized as rapidly as possible. This would cut down on duplicate purchasing of journals and different translations of the same document.
>
> There needs to be continued and increased use of foreign currencies generated by Public Law 480 (Food for Peace) shipments to foreign countries for acquisition of foreign scientific and technical information and its translation.
>
> Government scientists who attend national and international conferences where scientific and technical information is shared should provide reports to a central clearinghouse, which should also take steps to provide guidelines and coordination to reduce overlaps and wasting the time of participants.
>
> Restrictions on the flow of technical information resulting from reasons of security need to be frequently reviewed.

> All congressional committees need to give special attention to the scientific information activities for the departments and agencies under their jurisdiction, regardless of the size of an agency program. Aggregated for all departments the magnitude of programs is great.1

Although not proposed as recommendations, the framers of the Report asked about the urgent need of mechanization of information facities, how much is required and how users would be involved. They expressed concern about the lack of linguistic ability of users in the United States to read documents in foreign languages and wondered if machine translations would be perfected to pick up the slack. They addressed the subject of uniformity in data processing equipment produced by different manufacturers, worrying about the effect of lack of uniformity on the information processes of the Federal government. Finally, the Elliott Committee called on the President to convene a White House Conference on Scientific and Technical Information to bring together the men and women in government, industry, in the universities and in the non-profit organizations who create and use technical information. Such a Conference would not focus on solution of technical problems of indexing or equipment design, nor would attempt to solve the problem of duplication of effort in spending taxpayer money nor of how to get the various government information agencies to talk the same language. Instead:

> "Let us, rather, address ourselves to the larger and more basic question of how we may more effectively and more efficiently marshall our total resources of industry, institutions, and the government to define our common problems, to set up universal guidelines, to establish interlocking and complementary action programs in both the indexing fields, which will surely bring to us a better capability of knowing what we have done and of knowing what we are doing in science. While there is a $15 billion annual problem of this nature in the Federal government, the real problem is global in nature and might be viewed as such. If such a conference results in better comprehension of the situation we confront, and distributes among government, industry, and the other institutions the relevant portions of responsibility, then scientific and technical information and its effective use will present a less formidable face, and the feeling of "crisis" will diminish."2

1 Ibid, pages 89-91

2 Ibid, pages 91-93. Most of these comments are credited to R.G. Challar, National Cash Register Company.

It should be obvious to the reader that many of the findings and recommendations of the Elliott Report did not get implemented, and curiously, their thrust has not diminished with time substantially. One reason for the lack of attention to the Elliott Report has to do with the size of the overall endeavor of the Select Committee. Its multiple studies which sought to embrace the total field of Federal research and development was a guarantee that each of the series would only receive a limited amount of attention. Another reason had to do with the status of the Select Committee and its Chairman, Carl Elliott. There was a certain amount of jealousy when it was set up by various other House research and development committees and personalities. Election problems for the chairman also resulted in the braking of momentum, Thus, the follow-through on Study Number 4, Documentation and Dissemination of Research and Development Results was lacking. The White House Conference on Scientific and Technical Information, which the Committee advocated, never came to pass.

The Report is interesting for yet another reason, the Appendix. The Select Committee decided early in its effort to gather a considerable amount of information and data from the Federal agencies about their scientific and technical information activities. Much of this information has been tabulated in the Appendix in eleven exhibits. For scholars and the otherwise curious readers, the study of these exhibits could be fruitful. They contain: a COSATI Progress Report, objectives of Agency information programs, a list of Federal information facilities, representative data banks in DoD, Federal support of scientific and technical publications, a list of studies in Federal agencies to improve communication of R&D information, and a list of grants and contracts awarded by NSF in support of improved dissemination of scientific information.

Even though the Elliott Report did not make a significant impact on the Federal agencies and hardly receives mention currently, it was a valuable effort. It mirrored the concerns of the Legislative Branch in a most felicitous manner.

The interest of Congress in scientific and technical information matters has had a long history. The Committee on Expenditures in the Executive Departments, which ultimately became the Committee on Government Operations, held hearings on a bill (S.493) that was introduced by Senators Fulbright and Aiken to provide for the co-ordination of agencies disseminating technological and scientific information, and for the more efficient administration of an information exchange program. As reported in Senate Document No. 113 on Documentation, Indexing and Retrieval of Scientific Information:[1]

> "The bill was supported by many of the leading authorities of the scientific community who were familiar with the deficiencies of the Federal structure in this field. Its immediate objective was to enable the government to continue some of the scientific operations which had been developed during World War II, such as the National Inventors Council, the Office of Scientific Research and Development, etc. The proposed program was also designed to provide a medium for analyzing, classifying and distributing the vast amount of technological information gathered by these organizations, other Federal agencies, and by special teams composed of scientists, engineers, technicians, and researchers in Germany following the war. The bill (S.493) proposed that the Office of Technical Services in the Department of Commerce undertake to assemble, analyze, translate, and disseminate such information as was found to have potential benefit to American industry...

It is interesting to trace what happened to S.493, which was reported favorably to the Senate on June 27, 1947. Because scientists and industry opposed some features of the bill, the Senate decided to take no further action. Instead, the Congress created the National Science Foundation, which was to be supervised and directed by members of the scientific community. Susequently, Congress passed Public Law 776 (81st Congress, the Technological and Scientific Act of 1950) which gave the Office of Technical Services the authority proposed by S.493. Ironically, the funds needed to operate the program effectively were never appropriated by Congress.[2]

1 U.S. Senate, Documentation, Indexing, and Retrieval of Scientific Information: A Study of Federal and Non-Federal Science Information Processing and Retrieval Programs., Prepared by the Staff of the Committee on Government Operations, U.S. Govt. Printing Office, 1961

2 Ibid, pp3,4

An historian of Federal science information programs of the early 1960s would have to appreciate the extraordinary interest in this subject by Congress as demonstrated by hearings held and documents issued. The depth and intentness of the focus have never been equaled since. Credit needs to be given to Chairman of the Committee on Government Operations, Senator John L. McClellan, under whose leadership the inquiries were undertaken, also Senator Hubert H. Humphrey, Chairman, Subcommittee on Reorganization and International Organizations, who through his nonpareil contributions has achived a special footnote in the history of science communications. But credit needs to be given to several more individuals in Congress who participated in what amounted to a crusade.

One was Walter L. Reynolds, chief clerk and staff director of the Committee, who almost alone compiled Senate Document 113 on Documentation, Indexing and Retrieval of Scientific Information, "virtually a standard text on the use by the Federal Government of advanced methods to manage information generated by research and on up-to-date developments in private industry involving use of electronic data processing methods", according to Senator Humphrey.[1]

Praise for his excellent performance should also be given to Dr. Edward Wenk, Jr., senior specialist in science and technology, in the then Legislative Reference Service, Library of Congress, who surveyed the broad problem of coordination of information on current federally supported research and development, notably in the physical sciences. The insights of Dr. Wenk were particularly valuable when he became the Executive Secretary, Federal Council for Science and Technology, in the early 1960s. Senator Humphrey lauded his studies of the problems and opportunities of the Science Information Exchange as the "catalytic agent" that contributed to the establishment of SIE.[2]

1 U.S.Senate, Coordination of Information on Current Scientific Research and Development. Prepared by the staff of the Senate Committee on Government Operations,U.S. Government Printing Office, 1961

2 Ibid, pp viii, ix.

The third person singled out for his contributions was Joshua Stern, the Chief, Basic Instrumentation Section, National Bureau of Standards, for his work in preparing a review of how information is coordinated in the vast realm of federally supported electronics research, development, testing and evaluation. Interestingly, both Wenk and Stern "were given authority and freedom to come to their own conclusions in their own way", but both of their analyses were carried on in consultation with the project director of the Subcommittee on Reorganization and International Organizations, Mr. Julius N. Cahn.[1] Cahn's quiet contributions during this period and over the years deserve special praise.

In consideration of current developments/pertaining or lack thereof to scientific and technical information processes of the Federal government, the/ findings and recommendations of nine Wenk and Cahn deserve/attention even more today. They are:

1. Finding: No inventory of proposed or ongoing research exists in the Federal government or nationally. Registers were established for agricultural research 14 years ago, medical research 10 years ago, and biological research 7 years ago. These systems are deemed inadequate, except for the biosciences effort.

   Recommendation: The Special Assistant to the President for Science and Technology and the Federal Council for Science and Technology should devote increased attention to coordinated interagency planning and management of scientific research and development, and to the utilization of up-to-the-minute information therefor. The policy should be promulgated throughout the Federal Government that: (a) Decision-making on new R&D should be preceded not only by the standard procedure of consulting data on prior results, but by the consultation, to the extent feasible and desirable, of pertinent data on work already underway or work completed but not reported or published. (b) Agencies should be required to cooperate to the fullest extent with the Science Information Exchange

2. Finding: Strengthen Science Information Exchange.

   Recommendation: Improved input from Federal agencies, also their use of SIE. Undertake vigorous study to make possible inclusion of physical, social and other sciences information. New studies are needed to make SIE more successful in serving users.

3. Finding: Continue Documentation Center efforts toward coordination especially in overlapping fields.

   Recommendation: Centers such as the Armed Services Technical Information Center and the Office of Technical Services should continue efforts towards coordination and, as appropriate, integration of activities in management and dissemination of unclassified information. All Feder-

al documentation centers should vigorously endeavor to expand their program of cooperation with one another, and with the SIE. Need to record within a unified, government-wide complex a wide variety of pre- and post-publication data

4. Finding: Virtually no attention has been given to the overall role of professional societies in helping to develop and utilize prepublication systems for scientists and engineers, day-to-day decision-making and operations. Joint activities with other nations need to be improved. The Federal agencies are spending more than $100 million a year in oversea scientific programs.

Recommendation: Federal agencies strengthen cooperation with professional societies. International professional organizations should be invited to explore the worldwide phases of the problems and opportunities of information on work in progress.

5. Finding: It has been found that much too little is known about Federal scientific and technical information costs.

Recommendation: The National Science Foundation and the Federal Advisory Committee for Scientific Information should continue their commendable efforts to determine Federal outlay for scientific communication and information purposes and should receive fullest cooperation from the agencies. To the extent feasible, intensified effort should be made to estimate the indirect costs of information and communication.

6. Finding: Too little is known to carry out improvements of existing information and documentation systems, and changes in information gathering and utilization techniques.

Recommendation: More intensive studies should be conducted of scientists' information gathering and utilization patterns, particularly their usage of existing "in house" and contractual systems, of reports, articles, books and audiovisual materials.

7. Finding: The Department of Defense with the largest R&D program in the Federal government requires an internal review of its program.

Recommendation: The Office of the Secretary of Defense and the respective services should move ahead in resolving policy and operation problems of information systems and services.

8. Finding: Make information management a line item under Congress' control.

Recommendation: The Senate Committee on Appropriations may wish to consider requiring the SIE funding to be a budget line item, perhaps as a specific part of a larger item on management of pre- and post-publication scientific information. Alternatively, a line itme may be in the appropriations bills of NSF, DOE, if either of the two will support the SIE function

9. Finding: Analyses and projections on scientific manpower need strengthening.

Recommendation: The Federal Council for Science and Technology should give attention to strengthening information of scientific and engineering

manpower and needs. The National Science Foundation should develop with other agencies and the National Research Council estimates as to long range needs and preparation of scientists and engineers. SIE's data on manpower should be utilized to the fullest in such an effort.[1]

On January 26, 1961, the full Committee on Government Operations met and approved without dissent the following Statement of Policy on the Coordination of Current Research and Development, which is provided in excerpted form:

> Maximum efficiency in the Federal Government's $8.1 billion program of scientific research, development, testing and evaluation requires:
>
> 1. Review at the level of the Federal Council for Science and Technology of the information problems confronting the Nation's scientific manpower, now carrying on an estimated 160,000 R&D projects.
>
> 2. Fullest interagency cooperation with and use of the SIE for purposes of administrative and scientific efficiency.
>
> 3. Congressional controls over the funds of SIE by making the appropriations a line item in the Federal budget.
>
> 4. Improved management of information of Department of Defense including salvaging from canceled projects information and a study of the extent of duplication among and within projects.
>
> 5. Determination of direct and hidden costs of agency information-communication programs on scientific research and development.
>
> 6. Studies and improvement in Federal agency programs in handling scientific information on current and completed research.[2]

Senator Humphrey added several final and individual observations, which are excerpted and summarized:

> The Federal agencies have not capitalized upon the "revolution" which has occurred in the science of information storage and retrieval. They have paid little attention to the mountains of data on work in progress.
>
> Formal intra-agency information exist, but they cover only a segment of basic and applied R&D. The systems are a hodgepodge; they are overlapping, underplanned, undernourished, and underused. So far as data on current work is involved, the agencies use, with but few exceptions, "Model T" methods in a jet age. But a"Model T" will not suffice in an era of $8 billion Federal R&D support.

1 Ibid, pp 265-275

2 Ibid, page 275.

3 Ibid, page 276.

Returning to the fray in October 1963, Senator Hubert H. Humphrey, inserted a statement in the Congressional Record in which he stated that he was going to push vigorously toward continued progress in the STI problem area. Key excerpts from this statement are as follows: [1]

> ...In these next few months, I should like to mention several phases of the problems of Defense and of Government-wide research. (My purpose) is to get the greatest results in science and technology; in the shortest period of time; through the most efficient and economical use of taxpayer's resources...Not only the expenditure of money merits our attention; also at stake are greater values: the successful defense of America and the Free World, including the deterrence of war: the growth and prosperity of the civilian economy; a higher standard of living for our own and other peoples; and success in the conquest of disease and disability...
>
> Our entire nation must benefit - the defense and nondefense communities; the space and the nonspace communities,business,large and, particularly, small; all regions, not just those already well endowed with great university -defense complexes, nonprofit sources like universities, foundation, institutes, and cooperatives, dynamic industries and so-call lagging industries. To achieve all these goals requires many things. One of the things is information -- timely, reliable, easily accessible, reasonably complete information. ...The flow of information is not a luxury; it is a life and death necessity. This is not an exaggeration. It is a hard fact. ...In my judgement, the Defense Department and the Office of Technical Services (NTIS) have hardly "tapped the surface" (sic) of transmitting information to the nondefense community...

Humphrey commended the Department of Defense for expediting its effort to improve its overall STI program. He singled out the Army for its comprehensive program, but lamented that little interservice "pooling" of information is going on between the three services. How Vice President Humphrey would react to the current DoD STI program, if he were alive today, a program which has retrogressed considerably,the reader is free to conjecture.

[1] Humphrey, Hubert H., Defense Information on Science and Technology: Key to Progress in National Research, Congressional Record, October 9, 1963, summarized in the Army R&D Newsmagazine, November 1963, pp 4,528.

The efforts of Senator Humphrey and others in the Senate to improve Federal STI programs did not go unnoticed by others in the House of Representatives. One of the offbeat efforts was attempted by Congressman Roman C. Pucinski, who sought to establish an American counterpart or competitor to the Soviet VINITI, the massive Soviet STI center in Moscow. Pucinski headed a Subcommittee on Research Data Processing and Information Retrieval, House Labor Committee, at the time. He proposed a bill (H.R. 1946) to establish a National Research Information Center, which he hoped would be located in his home base, Chicago, Ill. It was clear at the time that the Congressman knew very little about the rapidly growing STI programs of the Federal agencies, but he did know that the U.S. government had no counterpart to VINITI, and being a competitive person, still feeling the effects of the Soviet launching of the SPUTNIK satellite, was resolved to meet the challenge. The House apparently was not as convinced of the need of such a center and voted the subcommittee a sum not to exceed $7000 for further investigations into the project. Recognizing that he had an up-hill battle on his hands, Pucinski held hearings on the subject, inviting several highly respected individuals to offer their views about the wisdom of his initiative. IBM chairman of the Board, Thomas J. Watson, Jr., Dr. Emanuel R. Piore, vice president for research and engineering, and Dr. E.H. Goldman, director of experimental systems, made statements about the need for better information systems.

Watson pointed out that no one has sufficient foresight to design an ultimate system in one big jump and that it must be built step by step using our existing technology. Piore stated: [1]

> To achieve the proposed goal of design and construction of a National Information System the solution of technical problems in three broad areas must be solved. These are methods for retrieving, processing, and disseminating information; development new programming systems; and, development of equipment which can be put together to form the desired system.

Dr. Goldman said that it is apparent that research in automatic translation and other forms of language processing is extremely relevant to the development of an efficient and economical information center. Dr. Louis T. Rader, president of Sperry Rand Corporation's UNIVAC Division, told the subcommittee that to meet the growing volume of complex STI problems as proposed in the center, a step-by-step approach, preceded by

[1] Wendel, Chas, Industry Favors National Information Center, Electronic News, Sept. 23, 1963, p.6.

careful planning and clear guidelines, must be adopted.

It would appear from the testimony that the witnesses carefully refrained from making statements that would reveal full support of the Pucinski Bill. Pucinski persisted in his effort to build up a constituency that would support his Center in Chicago. A news item written by a Washington Post financial writer provides some additional insight: [1]

> Plans for a national information center to carry out under one roof all the operations of collecting, processing, abstracting and coding scientific information were outlined here yesterday. The plans defy imagination. The proposed central clearinghouse would handle billions of bits of significant scientific data, making any single bit available at unheard of speed.

Pucinski, who began to learn about that time of the way STI is generated and handled in the public and private sectors in the United States, stated:

> I wish to stress that the purpose of the national information center is not to eliminate any of the existing indexing, abstracting and translating services, but rather to obtain their final work products in coded or other formalixed form and make them available to the technical and business community....The center will encourage the establishment of additional satellite centers wherever a need appears to exist.

Pucinski went on to point out that there was no abstracting service in the U.S. for the science of astronomy, even though there was an annual budget of $5 billion for space exploration. This, he found, was appalling, since the Russians do have such an abstracting journal. The full talk made by Pucinski appeared in the Congressional Record - Appendix, October 17, 1963. During the talk, Pucinski proposed that the National Science Foundation make an annual award, the Vannevar Bush Award, of $50,000 for the most important contribution in data processing and information retrieval. Since nothing came of the suggestion, NSF did not find it meritorious. He made another comment worth recording. After pointing out that there was an excellent network of abstracting and indexing activities in the U.S.and it would be a mistake to dump them into a single, monolithic intellectual compound, he stated:

> The basic philosophy behind the National Information Center can be summed up in the following maxim: Centralization without autonomy for

[1] Goodman, Oliver S., Plans for Science Center Cited, Washington Post, October 18, 1963, p. 23. Report of an all day symposium on information processing, Student Union Building, University of Maryland,attended by 600 persons.

> decentralized satellite operations is blind; decentralization without central coordination is dead. This maxim is a synthesis of corporate history in the free enterprise system. It is the elan vital behind the concept for a National Information Center.

Eleven days later, on October 28, 1963, the Congressional Record contains an interesting account of what happened on the floor of the House. In summary, Pucinski asked for authority to head a delegation that would go to Moscow and other countries to observe their STI gathering and disseminating centers. Recognizing that his $7,000 would not cover costs, he negotiated to obtain "counterpart funds" which become available for certain purposes through the sales of agricultural products to foreign countries. Unexpected objections came from other members of the House, one of them dealing with jurisdiction of STI matters. Praising the work of Daddario, Vinson, Price, Elliott, Pucinski maintained that jurisdiction for NSF's Office of Science Information Service belonged to the Education and Labor Committee, since the National Defense Education Act, which was the enabling legislation for NSF's OSIS, was written by that committee. The other House committees, he stated, were not focussed specifically on what H.R. 1946 wanted to accomplish. The Congressional Record covered the give and take on the floor, making for very interesting reading. At the end, a vote was taken and Pucinski's hope to visit VINITI was dashed. Perhaps, the death blow to H.R. 1946 came when NSF testified against the proposal. For without NSF funding, there would be no way to operate such a center. Mr. Pucinski, who is now an alderman in Chicago, was angry to the extreme at NSF for the coup de grace. Adkinson[2] summed up what happened with these words:

> Although the bill was not considered by any congressional committee, Congressman Pucinski's activities, which were reinforced by many recommendations for a national information system, persuaded many officials that the federal government should develop a national program for a coordinated network of sci-tech information centers... Even though the plan was not considered by COSATI or by any of the several congressional committees, it did add to the belief that a technolgically advanced national science information system should and could be developed.

Since Adkinson was the target for Pucinski's anger, the former was most gracious in

[1] Congressional Record - House, To Grant Additional Travel Authority to the Committee on Education and Labor, October 28, 1963, pp 19348-19352.

[2] Adkinson, Burton W., Two Centuries of Federal Information, Dowden, Hutchinson & Ross, Inc., Stroudsburg, Pa., 1978, p. 56

reporting the Pucinski initiative. A prediction and an epitaph for the project came in an editorial signed by Richard D. Kornblum. [1]

> This Fall, the House voted Rep. Pucinski's subcommittee (of the House Education and Labor Committee) a sum of money "not to exceed $7,000" for further investigations into the project. This prudent sum, earmarked for such a needed, top-priority study, is of interest when compared to the amount of U.S. cash invested in one of Mme. Nhu's typical days while touring this country - whether she be at the hairdressers or propagandizing for her regime's unpopular Vietnamese policies....(B)ased on some instances of governmental concepts of urgency and importance, the center's supporters may well have more trougle expediting their project than if they were proposing a new branch post office for a mountain hamlet.

Understandably, Rep. Pucinski showed little interest in STI matters during the rest of his stay in Congress. Had he sought to help improve Federal STI programs, rather than espousing a lost cause, he could have been a great help to those of us trying to improve Federal and national STI programs.

Turning to the Congressional Record, dated February 17,1965, there is an item reporting the proposal of S. 1136 for the establishment of a Commission on Science and Technology introduced by Senator McClellan, chairman of the Committee on Government Operations, together with Senators Mundt, Ribicoff, Gruening, and Yarborough. The bill provided for the establishment of a Hoover-type commission, composed of representatives from the legislative and executive brances of the government and of persons from private life who are eminent in one or more fields of science or engineering, or who are qualified and experienced in policy determination and administration of industrial scientific research and technological activities. Listing some of the deficiencies in Federal R&D that argued for the passage of the bill, there were mentions of STI. Referring to duplication of R&D, McLellan stated: [2]

> There is reason to believe that this occurs extensively, due primarily to serious deficiencies in the science information retrieval programs of the Federal government....The Commission would be...directed to study Federal STI activities, such as deficiencies in scientific engineering, and technical information programs, including adquisition,

[1] Kornblum, Richard D., The $7,000 Bequest, editorial in Business Automation, November 1963., p. 66

[2] Congressional Record - Senate, Proposed Commission on Science and Technology, February 17, 1965, pp 2709-2710

> processing, documentation, storage, retieval, and distribution of scientific information...One of the basic objectives of the bill is to provide a medium through which individual Members and committees of the Congress can obtain information which is not now available to enable them to take appropriate legislative action to establish definite Federal policies in the field of science and technology.

Nothing came of the bill, but it is interesting to note how important STI was considered by Members of the Senate. On a less lofty plane, it is also interesting to point out that the findings of the Elliott Select Committee on Documentation and Dissemination of Research and Development Results (Study Number IV), made the year before, was not regarded as sufficient by McClellan and the other senators.

In mid-1965, The Committee on Operations made a report prepared by its Subcommittee on Reorganization and International Organizations, chaired by Senator Ribicoff, available. [1] The report states that some subjects mentioned have not been covered in recent reports, hence they are presented in more detail.An example is STI- a subject which has been the focus of the subcommittees'attention since 1957.- and an area in which direct Federal expenditures are over $200 million annually. Indirect expenditures in the STI area that are indirect, not identified in present Federal budgeting,"are many times larger than the sums spend directly." About one-fourth of the 45-page /Senate Report is devoted to Section 2. Interagency Coordination of Scientific and Technical Information. The stated objective of Senate is to help assure maximum efficiency of Federal programs in storage, retrieval, review, and dissemination of STI and to reduce waste which comes from unintentional, unknowing duplication of R&D efforts For close to eight years, the Senate Committee on Government Operations and the Subcommittee on Reorganization and International Organizations have devoted concentrated and sustained attention toward encouraging improvements in Federal STI programs. To demonstrate what it had done, a chronology of publications (1958-1962) was provided. Additionally, a detailed analysis of the subcommittees activities during the 88th Congress that provides an agency-by-agency review of progress was also provided.

[1] U.S. Senate, Summary of Activities Toward Interagency Coordination, prepared by the Subcommittee on Reorganization and International Organizations, Committee on Government Operations, 89th Congress, 1st Session, Report No. 369, June 24, 1965, 45 pages

> Funds budgeted for publication in a Federal grant or contract should be designated as a "hard" item, not to be employed for other uses without specific approval from the responsible program officer.
>
> Journals using a two-track system (Track 1 - commitment of Federal funds will assure early printing. Track 2 - if funds are not committed, papers will be published but with a delay) should be required to make adequate provision for publishing papers for which page charges are not honored.
>
> All nonprofit journals with page charges should be asked to submit to the NSF's Office of Science Information Service an annual statement of circulation, costs, and income, with separate listings of bulk and publication time lags for papers that honor the page charges and those that do not. OSIS would then issue a list of publications that meet the FCST page charge criteria.
>
> Journals should adhere strictly to the currently prevailing practice of deciding on acceptance or rejection of papers before learning whether or not page charges will be honored.
>
> Groups of small scientific and technical societies that publish journals with overlapping readership should federate so as to publish their many journals as a single business operation.
>
> Journal publishers should actively explore and when possible implement new ways of packaging and marketing their products that are better adapted to the needs of users and users' desires.

There are several other recommendations dealing with keeping costs, serving users in developing countries, improving format and style, encouraging authors to write more lucidly, making scientists and technologists more aware of the value of scientific and technical journals and developing better marketing techniques.

It would be difficult to determine what effect the Herring Report had on those addressed in the government and the professional publishing society communities. The continuation of the page charge convention over the years has to be considered as a positive result, but this is conjectural because of the disappearance of NSF's Office of Science Information Service, the Committee on Scientific and Technical Information, the Federal Council for Science and Technology, and focal points in OSTP and the Federal R&D agencies. The turnover of research and information managers is so high that it is probably true that knowledge of the Herring Report in government has disappeared as well. The presumption follows that in accordance with the Santayana dictum that those who do not read history are bound to repeat it, comes a new reduction of R&D funds, a new generation will have to retrace the steps of the Herring Task Force.

A brief coverage of the factors responsible for progress includes the interest and work done by the Office of Science and Technology and the Committee on Scientific and Technical Information, the efforts of the Office of Science Information Service, NSF, the involvement of two House subcommittees(Pucinski and Elliott groups), professional society activities, the Council on Library Resources in the library area, and the information industry.

Looking into the future, the study discusses what remains to be done.These include:

- o Improved and integrated handling of STI within and between Federal agencies.
- o Control of physical items, including: a mechanized inventory of scientific journals and other publications issued serially; a cooperative cataloging system leading toward a mechanized national union catalog and specialized catalogs; an effective coordinated acquisitions program; and an effective transmission network for facsimile and microform.
- o Control of information contents of items, including general characterization of the contents of a book or article and identification of specific data, ideas,etc. Specifically, better comprehensive indexes on broad discipline and mission-oriented-bases, improvement of the National Data Reference System, also critical reviews and specialized information centers.
- o Improved access to the huge masses of knowledge generated by the Federal agencies made available by a "jumble of regional depository libraries, report, information, and other centers sponsored by the agencies in many locations" all operating in an uncoordinated manner. A comprehensive Washington 50-state probram is needed, a planned national system.
- o More needs to be done about regarding information as an agency, Federal, National and international resource. Not only must there be agency allegiance, but also a higher allegiance to serve the needs of the Federal government as a whole.
- o Within each department, individuals responsible for information should be part of management's top team, at the equivalent of Assistant Secretary level. We need a system of information subsystems with maximum compatibility and convertibility, featuring high-speed tanrsmission of information. The system should include provision for non-print data as well as print information.
- o There is every reason for boldness and a willingness to experiment soundly. Savings beyond comprehension may become possible -- savings in manpower, material, and perhaps most important, in time.

Almost two decades have passed since this report was prepared, yet many of the recommendations are as fresh as when they were offered. Unfortunately, the Committee on Government Operations has forgotten what it knew had to be done eighteen years ago. The loss of corporate memory has contributed to a phase-down of Federal STI programs, and with it we have lost the desire and ability to be bold and experiment soundly.

On December 30, 1965, Congressman Emilio Q. Daddario, Chairman of the Subcommittee on Science,Research, and Development, who was to have great influence in STI matters, submitted a report entitled The National Science Foundation -- Its Present and Future to Congressman George P. Miller, the Chairman of the full Committee on Science and Astronautics.[1] The report was the result of study and comprehensive hearings by the subcommittee, which spent about a year on the project. It was a critical report with the general conclusion that the Foundation was operating and organized to operate in a manner that was satisfactory a decade ago, but not for today and tomorrow.

STI programs were analyzed in the report as follows:

> The Foundation has not carried out a principal part of the information task assigned to it: the coordination of the science information activities of the several deparments and agencies. As a result, this function had to be assumed by the Federal Council for Science and Technology and its Committee on Scientific and Technical Information (COSATI)... The Foundation has the residual task of coordinating Federal science information, but even here COSATI seems to be the focal point. At present, it seems that NSF is only one of many Federal agencies active in science information and, in terms of money and size of operations, it is a junior member...The Foundation should continue its support of basic research and education in the information process..Congress will be looking to the Foundation for workable arrangements with the non-Federal (information) systems to encourage operations and financing so that they will become strong enough to avoid complete dependence on the Federal programs. Congress also will be interested in measures to indicate the quality of information contained in the national information network and to reduce low quality or superfluous information that seems to clutter present systems.
>
> The Foundation, having identified national needs for science and the intentions of other agencies, has a responsibility to compensate for any disparity in level of support or allocations among different fields of science; this is the balance-wheel function.
>
> The Foundation (should have) a more active, responsible function for Federal science information. Its research into fundamental processes of science information can be expected to improve the national science information network and to definitely identify the Foundation as a leader in in the science of information, both among Federal deparments and agencies, and among the non-Federal parts of the network.With increasing competence and extensive relations within the world of science information, the Foundation should become a major element of the impending effort to improve coordination of all the parts of the national information network.

The recommendations of the Daddario report were accepted by the Foundation at the time, but with the passage of years, both NSF and the Subcommittee seemingly forgot the message.

1 U.S. House of Representatives, The National Science Foundation: Its Present and Future, Report of Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, 89th Congress, U.S. Govt. Printing Office, Washington, D.C.,pp 118 (1966).

The next involvement of Congress was in mid-1966. On this occasion, the Subcommittee on Science, Research and Development, Committee on Science and Astronautics, held hearings on H.R. 15638, a bill to provide for the collection, compilation, critical evaluation, publication, and sale of standard reference data. It was a proposal from the Administration to set up a comprehensive Standard Reference Data System within the National Bureau of Standards, Department of Commerce. This program had been created in fact in June 1963 through the efforts of the Office of Science and Technology.[1] Testifying before the Subcommittee were: Dr. Donald F. Hornig, Director of the Office of Science and Technology; Dr. J. Herbert Hollomon, Assistant Secretary of Commerce for Science and Technology; Dr. Allen V. Astin, Director of the National Bureau of Standards; Dr. Frederick Seitz, President, National Academy of Sciences. These witnesses were positive in their comments that the bill should be passed. Testifying with some reservations about the bill were Curtis G. Benjamin, chairman of the board, McGraw-Hill Book Co. and W. Bradford Wiley, president, John Wiley & Sons, Publishers. The concerns of the latter dealt with the authority to copyright critical data gathered by the National Standard Reference Data System and the status of the private sector in the future. Joining the last two at subsequent hearings was William T. Knox, then a vice-president at McGraw-Hill Book Co. Knox expressed some of the same misgivings. The bill ultimately passed. Credit should be given for the creation of the program to Dr. Edward L.Brady, National Bureau of Standards, who was also one of the charter members of COSATI. The NSRDS program still exists today, recognized throughout the world as one of the achievements of the U.S. government. It is now a key element of an international program - COSATA - which operates under the United Nations.

[1] U.S.House of Representatives, A Bill to Provide a Standard Reference Data System, Hearings before the Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics, 88th Congress, Washington D.C., June 28, 29, and 30, 1966, pp 181.

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One of the interesting documents to come from Congress is a speech made by the awarder of the Golden Fleece, Senator William Proxmire,to the American Management Association. [1] His opening comment was bound to arouse attention. He said, "The information explosion has a bright, sure and immediate future!" It is suspected that he used the word "explosion" in a non-conventional way. He added:

> Congress has recognized this in many ways. The Federal Government itself has gone in a big way into computers and data processing to organize and use the vast amount of information it develops.

After discussing computers and their use in the Federal government, the Senator shifted to the proposed Commission on Science and Technology, for which he saw a future. He stated:

> ...(S)ome federal agencies alone are engaged in scientific research of one kind or another. If we can find some way to pull together the fruits of all this endeavor, we surely have the means to make it available to you. What a boon it wood be if we had, say, a Central Scientific Data Distribution Office. This would be a facility where information of all sorts would be available to you in its simplest form -- on computers. Whether we will ever reach that point, I cannot say. But, why not? When the Commission gets off the ground, we conceivably could develop some plan for sharing information once we learn exactly what we have. And information --as I have said-- is what we have more of each day. The problem is now to put it to use. That we cannot do if we cannot share it with the people who can use it.

The good Senator is acclaimed as a bright and capable person, who concedes to no other member of Congress more zeal than he in uncovering waste and fraud in the Federal government, and, on rare occasions, in the Legislative Branch. But in this case, he is awarded a Golden Fleece for not following up on his 1966 comments. His interest in improving Federal STI programs and obtaining better utilization from the knowledge generated in Federal R&D was not translated to actions in subsequent years.

The Daddario Subcommittee came up with another report, this time on Science, Technology and Public Policy. While scientific and technical information review was not the purpose of this investigation by Dr. Warren H. Donnelly and other members of the Science

[1] Proxmire, William, Speech to American Management Association, (untitled), New York, New York, March 1, 1966. pp 6.

[2] U.S. House of Representatives, Science, Technology, and Public Policy During the 90th Congress, Report of the Subcommittee on Science, Research and Development of the Committee on Science & Astronautics, June 7, 1967, pp 202.

Policy Research Division, Congressional Research Service, there are a number of references to Federal STI interspersed in the document. These include: reference to the COSATI task group on national information systems and its blueprint for action and support for forward movement in the handling of scientific and technical documents, the passage of the National Standard Reference Data System bill by the House on August 15, 1966, not then acted upon by the Senate. the establishment of the State Technical Services Act of 1965 that increased the flow of STI from the Federal government to the states, medical library research, satellite communications, atmospheric and space research, technology utilization, and water research, and other areas that call for STI and data programs. The Donnelly report portrays the vigor of Federal R&D during the mid-1960s and indirectly the build-up of Federal STI programs that support the R&D.

Somewhat outside the compass of this book is the subject of Federal statistical programs, but there was an extraordinary controversy about the plan of the Bureau of the Budget to establish a national Data Center to improve the coordination and integration of governmental statistical programs. In its 1967 Economic Report, the Joint Economic Committee directed the Subcommittee on Economic Statistics to look into the possibilities of a truly integrated system providing genuinely comparable statistics consistent with and meshed into an overall system of e conomic statistics including the Federal, State and local governments.[1] Two considerations gave rise to the directive: (1) statistical information about the economy is necessary for good management in both the public and private sectors; and (2) at this time in the evolution of our statistical services, significant improvements lie in the direction of further coordination and integration. Respondents to the Subcommittee agreed that improvements were needed so that the data can be more effectively used in analysis and policy.

[1] U.S. Congress, The Coordination and Integration of Government Statistical Programs, Report of the Subcommittee on Economic Statistics, Joint Economic Committee, Congress of the United States, Joint Committee Print, U.S. Gov. Printing Office, August 9, 1967, pp 10.

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This general feeling was succinctly expressed by Prof. Wassily Leontief, of Harvard:

> The postwar revolution in economic programing and management techniques reinforced by unprecedented advances in data processing technology has made the traditional approach to collection,organization, and the dissemination of facts and figures describing the operation of the American economy and the social conditions of public and private life of the 180 million of American citizens completely obsolete. [1]

The Subcommittee on Economic Statistics points out that the coordination and integration of Government statistical progams involves more than the organization of governmental bureaucracy, though this is important. Nothing less than the quality of our public and private economic policies are at stake. As early as 1957, the National Accounts Review Committee, set up by the National Bureau of Economic Research at the request of the Bureau of the Budget stated: [2]

> Integration of the national economic accounts is desirable from three points of view. First, many economic problems require the use of several different kinds of information, and it is often necessary to move from the information provided by one kind of economic accounts to that provided by another. Second, from a statistical point of view, integrating the various kinds of economic accounts makes the best use of the available data, with less duplication and with improvement in statistical accuracy. Finally, for the user of the national economic accounts, a single integrated system is easier to understand and use correctly than a number of different apparently unrelated or overlapping systems.

Another Congressional document, reporting the hearings before the Subcommittee on Economic Statistics, appeared.[3] A quick reading of the document reveals that the witnesses were in general agreement with the notion of a National Data Center.

The Office of Bureau and Budget, under impression that there was a consensus for the new program, made an announcement that it was moving in that direction. Shortly thereafter "all hell broke loose." Even though thought was given to the possibility that the work of the Center would present a threat to personal privacy by the Subcommittee on Economic Statistics. It was the view of that group that further integration can and should be attained without sacrificing principles of personal privacy.

[1] Subcommittee on Economic Statistics of the Joint Economic Committee, Improved Statistics for Economic Growth: A Compendium of Views and Suggestions from Individuals, Organizations and Statistics Users, July 1965, p. 90.

[2] Bureau of the Budget, Report of the Task Force on the Storage of and Access to Government Statistics, October 1966, p. 5.

3 Joint Economic Committee, U.S. Congress, The Coordination and Integration of Government Statistical Programs, Report of the Subcommittee on Economic Statistics, May 17, 18, June 7,8, 1967, U.S. Gov. Printing Office, Washington, D.C., pp 206.

(See pages 7 and 8 of the Subcommittee Report). It will be remembered that this was the era during which Senator Ervin of North Carolina was operating in high gear to the applause of the print and television media.The issue of privacy was being magnified to the point that the nightmares envisoned by Orwell in "1984" were increasingly common. The demon being exorcized was Big Government at that time, government bent on destroying the privacy of individuals. In this kind of an environment, it was inevitable that the concept of a National Data Center was doomed - expelled. It is sad to think that the experience that brought scars to the Bureau of the Budget will probably prevent the Office of Management and Budget from creating a similar center in the future, regardless of value or need. In a derivative way, information scientists who believe that progress in the future will come from making it easy to combine and intermingle scientific, technical, societal (economic and other) information and data should remember it will take more than technology and techniques to make it happen. Passage from one level of communication to a higher one can be rough, indeed. We can foresee a long series of cultural impediments to improved information and databases and their communication, if (1) privacy and loss of liberty can be claimed, and (2) political dividends can be sought by opposing the improved information-communication systems.

Congressman Emilio Q. Daddario, chairman of the Subcommittee on Science, Research, and Development, called for a study by the Congressional Research Service, Library of Congress, to determine what the Federal agencies involved in R&D were doing about international programs. Headed by Dr. Freeman H. Quimby, Science Policy Research Division, a team prepared and submitted a report to Daddario in response.[1] The report turned out to be valuable, and even as this book is being written some 17 years later, it is clear that the report remains unique and still contains useful information. The report deals with the highlights of the international scientific activ-

[1] U.S. House of Representatives, 90th Congress, The Participation of Federal Agencies in International Scientific Programs, Committee Print, Report of the Science Policy Research and Foreign Affairs Divisions, Legislative Reference Service, to the Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, U.S. Govt. Printing Office, Washington, D.C. ,1967, pp 167.

ities of the Executive Branch which have cooperative programs with scientiss in other countries. The interchange of STI is what this report is all about. In addition to the interaction of the Federal agencies, the report delves into the role of the National Academy of Sciences, the Federal Council for Science and Technology, and relevant State Department functions. The report also paints a picture of such international organizations as: ICSU, UNESCO, OECD, United Nations, and others. International programs are given coverage, programs such as COSATA (ICSU Committee on Data for Science and Technology), COSPAR (Committee on Space Research of the ICSU), GARP (Global atmospheric research program), IBP (International biological program), IQSY (International Years of the Quiet Sun), and WWW (World weather watch).

There would be no purpose in going into further detail, but reading the document stimulates a few thoughts. The first of these is: why did not the Executive Office of the President, the leadership group of the Federal agencies, prepare the inventory and review? It is an important question because 17 years have passed since the Quimby team did the job, and there seems to be no desire on the part of the Executive Office of the President to (1) know what is going on in the international exchange area and (2) be concerned about policy and management aspects of our international commerce in STI, a vast and costly effort. Bearing in mind that all of the data gathered by the study team had to be wrested from the Federal agencies, there should have been expectation that Congress would look once again at this field, especially in light of the deep concern shown by the Administration for the prtection of vital technical "know-how" in the last few years. COSATI could have been given the job, since it had a functioning Task Group on International STI Exchange in place. The task could have been given to the National Science Foundation after COSATI was terminated, but this did not happen. The question still remains: How can a country like the United States, a country which is a leader in science and technology, a country deeply involved in international traffic of STI, a country which leads the world in information and communications - why did it not take instruction from the probe undertaken by the Congress and organize itself to gather such information as a matter of routine?

We go to the Congressional Record [1] again to report a joint resolution, this time, dealing with authority for the Advisory Commission on Intergovernmental Relations to study the feasibility of a computer system to help state and local governments to participate more effectively in federally assisted programs. Senator Edward Kennedy of Massachusetts introduced the proposal. Here is another Congressional initiative that may appear to be somewhat outside the STI area, but there is a lesson to be learned and a reference that information scientists and other scholars may want to remember. The issue arose because information that states and municipal governments needed to take advantage of Federal laws that could provide aid was not easy to get, on one hand, and a recognition, even in 1967, that modern information technology could provide such knowledge to the various governments with relative ease, on the other. Of use in the development of information systems is a preliminary examination of the subject by an IBM study team and a study on Computers and the Public Welfare, Law Enforcement, Social Services and Data Banks, by Harold B. Johnson, Office of the Director of Telecommunications Management, Executive Office of the President. Returning to the comments of Senator Kennedy, he provided many statistics revealing the large number of programs that deal with education, environment, poverty or community development. He tells about the increasing number of Federal agencies involved in the programs. Then he states:

> But the problem the resolution I introduce today addresses itself to is not solely one of the multiplicity of Federal programs. It is also focused on the incredible maze of State and local governmental units. Using 1962 figures, the latest complete ones, we find 3,000 counties, 18,000 municipalities, 17,000 townships, 35,000 school districts, 1,000 housing and urban renewal districts, 2,200 drainage districts, 2,400 soil conservation districts, 3,200 fire districts, and 700 health and fire districts. There are, in all, 92,000 local governmental units -- many of them fiscally and administratively independent. It is these units with which the Federal program administrators must deal, in large part.

It seems to the writer that Senator Kennedy was addressing a challenge that will be

[1] Congressional Record - Senate, Computer Systems for State and Local Governments, August 30, 1967, PP S12590-S12597.

reverberating all around the United States for generations. Most local units and their geographical boundaries came about as a result of the transporation and communications technology that existed at the time of their birth. With the arrival of information technology that changes the relation of time and space to people, making the enlarged "global village" a new and reachable reality, the number of units of government now operating, each with its own overhead, can be reduced in the name of economy, with the possibility of improved efficiency an extra dividend. It is recognized that political entities are unually not amenable to consolidation or termination. Nevertheless, this has to be one route to improved productivity, efficiency and economy in governance. Can we get by with 72,000 local governmental units instead of the 92,000 or more that exist today? If not 72,000, how about 80,000? Will the establishment of information systems, such as called for by Senator Kennedy, expedite such a mass movement or, conceivably, hold it off? There are no easy answers, of course. If we substitute scientific branches and fields for governmental units, what will be the effect of tying them together via electronic information networks? Will some of the boundaries between scientific disciplines and related technologies be reduced or eliminated as scientific and technical information networks proliferate? Will the overhead for American science and technology operations be affected one way or another? Only time will tell, but itseems that consolidation resulting from highly improved information technology and techniques will have its inning in a variety of fields now compartmentalized by custom, geography and earlier technology.

Another senator who "threw his hat into the information ring" was Senator James B. Pearson of Kansas. In October 1967, he made an address to a group of agricultural scientists and government administrators.[1] Pearson developed his comments around the experience of the Senate Subcommittee on Reorganization which conducted a study of pesticides between 1963 and 1966.

[1] Pearson, James B., The Role of Scientific Information in Public Policy, Address made at the National Bureau of Standards, Gaithersburg, Md., to scientific confereess on pesticides, October 27, 1967, pp 6.

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Said the Senator, "Scientific information has become so vital to public policy making that we must develop a better system of effective and speedy exchange of information among scientists, administrators, legislators and the general public." He added:

> Technological innovations such as pesticides have risks as well as benefits for society and, therefore,must be regulated. Translating the concept of the benefit-risk equation into public policy is always attended by controversy, but conflicts are sharpest when there is insufficient information to measure the benefits and the risks. At the time the Committee's investigation began there was a great deal of public concern that pesticides constituted a serious threat to wildlife and consumer safety However, by the time all the available information had been marshalled this earlier public fear had been replaced by public confidence that the benefits and risks of pesticides were favorably balanced. If Congress had attempted to write new laws during this emotional period in 1963 and 1964 it would have made a serious mistake.
>
> Because of increasing technical capacity to manipulate our environment it is vital that we must develop some type of centralized information retrieval and exchange program; better coordinate Government regulatory activities and research efforts; and do a better job of public education to assure that the public is informed as to the proper and safe use of such technologies as pesticides.

An important point made by the Senate Subcommittee on Reorganization was that the quantity and quality of exiting information dealing with the benefits and risks of chemical pesiticides was far more extensive that was originally assumed. This posed questions about how well the results of existing research had been widely distibuted and assimilated. The public and many policy makers were not sufficiently aware of this knowledge, it was found. However, there was a need to know a great deal more and only new research could provide such knowledge. It is more important to be able to bring together all that is currently known about a given and bothersome subject than only to be concerned about eliminating the duplicaation of research, important though this may be. The Subcommittee found that the process of information exchange among scientists, government administrators and legislators needed to be speeded-up. Scientists must not only present good information to help the legislator, he must also put it into the form that will make it understandable and helpful. The scientist who places himself above or immune from the political process "deludes himself and diminishes his possible contribution to the making of public policy." It is the

view of Pearson that the scientific community shirks its presponsibility when it tells society: Here are the facts; do with them as you will. Nor can a scientist say because I believe the knowledge I have developed may be harmful to society, I will withhold it from the public. Nor should the scientific community attempt to act as society's conscience, rather:

> It can be more sensitive to the impact that the results of a scientific investigation may have on society and it can do this by generating additional research designed to demonstrate all the undesirable and desirable ramifications that might be associated with the introduction of pesticides use, including both risks and benefits, and disseminating the information to the public and policy makers. It would seem to me that Land Grant Universities and Experimental Stations could have been doing more to explore to explore risks and benefits and disseminating this information to the public and to policy-makers.

A decade and a half has passed since Pearson made his remarks at Gaithersburg. There is no evidence that his recommendations have borne fruit. Unfortunately, pesticides are usually developed by industry whose views on disclosure are colored by economic competition. Too often, regulatory bodies that try hard to protect the public's interest and safety are reviled by other members of Congress more concerned with the protection of the commercial interests that are located in their states. Pearson did not address this problem in his remarks. The resolution of conflicts between the makers of pesticides, dangerous ones, that is, and scientists representing the public, joined to the resolution of conflicts of interest that legislators continue to face add up to the certainty that STI is and can be treated as a form of political expression. This is unfortunate.

About a week after Senator Pearson made his useful presentation, another one was made by Congressman Charles A. Mosher of Ohio, at the National Bureau of Standards in Gaithersburg.[1] Mosher made a number of interesting comments, a few of which will be mentioned. He asserted in his introduction that suddenly "the federal es tablishment is the most influential, most dymanic, initiating and innovative force in the whole realm of technology." This is one of the points that the author feels has to be stressed in writing about STI during this key era. Federal STI flourished during the

[1] Mosher, Charles, A., Address to Scientists and Managers of Federal Information and Analysis Centers, Address to the COSATI Forum of Federally Supported Information Analysis Centers, National Bureau of Standards, November 7, 1967, pp 15.

period when Federal R&D was the most dynamic, initiating and innovative force in technology. As the fecundity of Federal R&D declined, so did the Federal STI program. Reversing this, the decline of the Federal STI program paralleled the increasing barrenness of the Federal R&D program. It is not asserted here that other factors beyond the health of the Federal STI program did not contribute to the decline of Federal R&D, but the conclusion of close relationship is inescapable. Mosher also points out that the Federal organizations that were formed to manage Federal R&D activities - the Office of Naval Research, the Atomic Energy Commission, the National Science Foundation, the National Institutes of Health, NASA, the Office of Science and Technology, and the National Bureau of Standards - were "created by decision and direction of the Congress." They are constantly the subject of Congressional oversight, annually dependent on Congress for funding. He asserts that:

> National science and enginering policy is thus now intimately and irretrievably interdependent with national, economic, social, military, foreign affairs, and domestic policy consideration. Thus, scientists and engineers and congressman also are intimately interdependent (and) must learn quickly how to communicate with and understand each other more effectively. The prime question I am raising here today is whether or how we congressmen can adquately comprehend and make use of science and technology in determining national policy. Restating it in a different way, the question is whether or now significant technical information and advice can be effectively brought to bear on the legislative process...The basic requirement for making good decisions in the Congress is to obtain occurate, adequate and significant information. And that is the principal point I want to make today. The basic requirement, if we in the Congress are to make valid, sound, viable decisions, is that we obtain accurate,adequate, significant information to: identify and illuminate alternatives, provide criteria for choice, and facilitate the necessary political strategies. We need scientific and and technical <u>management</u> information (more than) pure STI (on such matters as) funding, schedules, manpower, objectives, and duplicate effort.

Mosher than summarized the number of diferent steps taken by Congress to obtain technical information and support from groups and individuals from within and outside of the government. (The information required appears to be a mix of STI and R&D management information and data.) He also talked about how Congress is organized to legislate and provide oversight on Federal R&D at length. He completed his remarks by mentioning what was then a new interest of Congress, the need for assessment in advance of new technologies the social, economic and political effects

that might be expected. The need, as he saw it, was for an early warning system that would provide an accurate assessment of alternatives, incentives, and direction. He expressed the view, then held, that a technology assessment capability could be a "galvanizing stimulus to the whole innovative process in our country." Unfortunately, this view, so hopeful and optimistic at the time, has fewer adherents today. The establishment of the Office of Technology Assessment by Congress has been marked by internecine warfare, self-doubt and a muted voice. From the viewpoint of the Federal STI community, OTA has been of less help in recommending the strengthening of Federal STI programs than it should have been. It has been diligent, it should be said in its defense, in reviewing the larger matters of information technology and communication. Mosher's observation that Congress is more concerned with scientific and technical management information than with "pure" STI seems valid, but it should be pointed out that Mosher, like Senator Pearson, underscores the importance of the latter more than he does the management information they need in budgetary and oversight matters in Congress. In truth, both kinds of information are important.

Six months later, the subject of science, technology and public policy stimulated a committee print produced by the Congressional Research Service at the request of Representative Emilio Q. Daddario. [1] As Congressman Daddario said in his letter of transmittal to the head of the Committee on Science and Astronautics:

> This report is the first of the follow-on series and covers the year 1967. It illuminates the two faces of governing science and technology: fostering science and technology, their resources and applications; and controlling, regulating those applications which interact so strongly with the public interest that Government action becomes necessary. The discussion of these two faces in one report helps us to realize how widespread is the eesponsibity of the legislative branch. The scientist can focus his efforts in pursuit of new knowledge. The engineer and technologist can concentrate on applying that knowledge. The legislator, however, must be concerned not only with providing a favorable environment and must of the wherewithal for their efforts, but he must also be concerned with the unintended, unexpected side effects.

The Report then is a collection of items that in total reflect what happened during the

[1] Donnelly, Warren H., et al, Science, Technology and Public Policy During the 90th Congress, Committee Print, Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, 90th Congress, Second Session, U.S. Govt. Printing Office, Washington, D.C. 1968, pp 85.

year 1967. Interspersed through the Report are references to STI, the communication of technical and related knowledge, and their applications. Some of these are summarized as follows:

> A noteworthy point of departure for this chapter... is the report that the National Academy of Science prepared for the House Committee on Science and Astronautics.[1] Panel Chairman Dr. Harvery Prooks noted as perhaps most striking the apparent conclusion that the most important modern invention in the pursuit of modern applied science is the big, mission-oriented industrial or Government laboratory. (This assertion should be of more than passing interest to the STI managers of these laboratories.

Dr. Brooks, who, it will be remembered, was a member of the President's Science Advisory Committee (PSAC) that commissioned the Weinberg Report reported out in 1963, said of this congressional report:

> The key points can be summarized in three words: "flexibility, communications, and interdisciplinarity." "Flexibility" referred to the ability to react quickly to change in both the technology itself and the perception of the problem to be solved. Regarding "communications" it is a process from research through development involving a series of overlapping activities with constant feedback between them, including a high degreee of personal mobility between the stages. An "interdisciplinarity" approach is needed because applied problems call for solutions that involve more than one scientific or technological discipline, thus there must be considerable communication within and outside the organization.

President Lyndon Johnson, about whom more will be written later in this book, asserted when he signed the State Technical Services Act in 1965 (Public Law 89-182): 79 Stat. 679)"

> The test of our generation will not be the accumulation of knowledge... Our test will be how well we apply that knowledge for the betterment of mankind."

The need for better technology transfer is what the President and others were calling for during the mid-1960s, Was the country matching the potentials of new discoveries and developments in science and engineering, and especially the knowledge generated through Government R&D, to the needs of commerce or public programs. The question was whether or not the rate of transfer was less than desired, and "whether available

[1] National Academy of Sciences. Applied Science and Technological Progress, Washington, D.C., U.S. Govt. Printing Office, 1967, 434 pages.

information is lost and wasted. The study reported on the accomplishments of the Air Force Project for Legal Information Through Electronics (LITE) in computer retrieval of legal information, the importance of patents and copyright laws which encourage the diffusion of inventions and foster innovation, and the work of the COSATI task force on legal aspects of national information systems (1967), which will be reported in the chapter on COSATI and its contributions. Information matters were discussed in another part of the report. Mentioned were the Standard Reference Data Act, proposals for a Federal Data Center, an inquiry into the coordination of governmental statistical programs, and the 1966 COSATI Progress Report, detailing the accomplishments of COSATI and the participating Federal agencies. The report discussed progress in communications (public broadcasting, subscription television), and the need for several new standards. In summary, the Subcommittee on Science, Research, and Development's 1967 report covered a number of themes in which STI figured heavily in the crusade to derive more gain from the fruits of Federal R&D. While Congress continued to show zeal in the technology transfer area, while President Johnson could call for better application of knowledge,/change of Administrations came along to neutralize the progress hoped for, or at least, postpone actions in the Executive Branch that could maintain the momentum achieved up to that point.

In 1969, Congressman Emilio Q. Daddario was considered to be the spokesman of Congress on matters pertaining to STI. His deep interest was never more apparent than in his remarks to the National Engineering Information Conference held at the Department of State on June 24, 1969. [1] A brief summary of his presentation is provided:

> As our nation stands on the threshold of the 1970 decade, there is a a growing awareness of the criticality of information for decisionmaking. It is significant that this conference, with participation by eminent private and public sector representatives, should choose to focus upon information resources and developing information systems. It is unfortunate, however, that such a conference should have so little progress to discuss after ten years...Qualified individuals and groups... have studied and restudied the need for an improved national capability of handling vital information. No definitive action has been taken by those responsible for establishing and sustaining such a resource.

[1] Daddario, Emilio Q., Information: Our Most Vital National Resource, Address to the National Engineering Information Conference, 24 June 1969. The presentation is included as Exhibit L, Recommendations for Improving the Dissemination of Federal STI, Report of the COSATI Task Group on Dissemination of Information, July 1970. pp 124. (The Daddario talk is found on pages 118 - 123.)

> There are many in Congress who share my discomfort as we view the strenuous efforts undertaken by "blue ribbon"groups during the past decade... efforts which resulted in excellent, thought-provoking reports but no subsequent implementing action...Starting from a base of existing information centers...there is no reason why this progressive country cannot develop a national information handling system of unparalleled effectiveness.

Daddario described the key centers and activities of the Federal government, and then outlined the six concepts that were analyzed in the 1965 report by the Systems Development Corporation to COSATI. These will be discussed in the section of this book devoted to the work of COSATI. Daddario discussed the proposal of Congressman Pucinski calling for a science information processing center, a bill proposing the establishment of a National Commission on Libraries and Information Science, the need for a broad-based "overall planning" effort, the question of intergovernmental information exchange, and an action undertaken by Senator Mike Mansfield calling for the delivery of documentation of ong-going research projects. This special effort was necessary because of the continuing lack of such vital information, sorely needed by governmental planners and private groups alike. Daddario told the attendees about the work of Senator Jennings Randloph to encourage technology transfer. He commented on the work of Dr. Chalmers W. Sherwin proposing a comprehensive, specific, phased plan to develop a machine-language compatible record for international scientific and technical communications, pointing out that the Federal Council for Science and Technology had not chosen to implement the Sherwin plan. He then stated:

> All of my remarks add up to a rather messy picture. The Nation deserves better treatment. The STINFO community has a responsibility to set the record straight...The crisis grows and Congress is becoming more discontented...There is no excuse for poor or non-existent STI systems, and I suspect that all too often the reason for these inadequacies is found in the inertia or short-sightedness of the bureaucratic management.

After these hard criticisms, Daddario made four recommendations to improve the Federal program:

> There must be in this day and age a responsible office close to the Presdient which has both the authority and the responsibility for bringing about a definitive improvement in our national information handling capability.
>
> This office must be given adequate resources--personnel and money-- to perform its assigned tasks.

> A hand-picked professional staff must comprise this office, for the success of formulating, implementing, and managing this sort of complex, long-term control and coordination effort will depend in large part upon the quality of the leadership and operating personnel.
>
> The office must establish and maintain the closest possible rapport with the Congress, so that the planning, programming, and budgeting determinations reflect as accurately as possible the needs of the Nation and the thinking of both executive and legislative branch leaders.

He then went on to say:

> If you examine these recommendations you may realize that I am calling, in actuality, for the strenthening of the Office Of Science and Technology. This staff arm of the President has performed heroic duty, under incredible odds, to bring order out of its disaray. It has had to rely all too often on the ability of its complement to cajole and convince member agencies that they should cooperate. It is my firm belief that the OST element responsible for the action I have delineated--and I refer to the Committee on Scientific and Technical Information--must be given the wherewithal to carry out these top priority tasks.

The leaders of the Office of Science and Technology obviously did not take what Congressman Daddario had to say too seriously. Nothing was done to strengthen the support of the STI component of OST, nor was any consideration given to helping COSATI get more done. Interestingly, what Daddario said was similar to what Senator Humphrey had stated in the early 1960s, although a considerable amount of effort had been expended by OST, COSATI and the Federal agencies to improve the Federal STI program after promising Humphrey that they would do so. No such promises were made to Daddario, since the confrontational style employed by Humphrey was not used to back up the broadside fired by Daddario. It was not more than a number of months later that the Science Adviser "got rid" of COSATI by transferring it to what was to become the graveyard of STI programs - the National Science Foundation. A couple of years later, the Science Advisor and the Office of Science and Technology were dismissed by the then President Richard Nixon, who had little admiration for the "fractious scientists" who he found irritating and overly independent. There is no inference that the expulsion of COSATI had any causal effect. When Congressman left the Congress a few years later, the Federal STI community lost a strong friend and champion.

It was in 1967 that Congressman and his Subcommittee called on the Legislative Reference Service of the Library of Congress to undertake a study that turned out to be

an "interesting, demanding, and productive assignment," according to the Director, Congressional Research Service, Lester S. Jayson. In submitting it to the Chairman of the Committee on Science and Astrnautics, Cong. George P. Miller on April 20,1969, Daddario said about the report Technical Information for Congress, [1]

> This report by the Science Policy Research Division of the Library of Congress...represents a major effort to delineate the kinds of scientific and technological problems which Congress is being increasingly called upon to face. It also illustrates in specific terms just how these problems have been approached and handled by the Congress during peak technological era in American history - that is, the period from the close of World War II up to the present time. The report should be of use to every member of the Congress...We believe the effect of the report will be a lasting one, both as a reference work of great intrinsic merit and as a guide to the science policies of tomorrow.

The project was undertaken by the late Dr. Franklin P. Huddle of the Science Policy Division and his staff. The project was monitored by Mr. Philip B. Yeager, counsel to the Committee on Science and Astronautics, whose support for improved Federal STI programs was long and constant. Perhaps it is improper to call the Huddle study an epic, but in its extraordinary design, coverage and insights, it is hardly short of that. In no way does its prosaic title reveal the contents of this masterwork. A short summary of its preface will help.

> Few politicians are scientists, and few scientists are politicians. In the communication of technical information from one group to another, some members of the receiving group, as well as the members of the transmitting group, need to have special qualifications. (Congress increasingly) needs support by specialists with adequate and sound qualifications for understanding, analyzing, and interpreting technical testimony. Technical issues requiring congressional resolution are becoming broader in scope; they are more serious, more complex, and more urgent. Information about them is voluminous and abstruse. The division of labor among the continuing committees of Congress, bu which some Members become quasi-specialists on each issue, is becoming increasingly hard to plan and execute. Congressional penetration into new technical issues is becoming more onerous and time consuming. Arrangements are needed to shorten the lead-time in the making of congressional decisions on technical matters. Leadtime can be shortened by improving the management of technical information. Sound management of technical information can improve the sources of information to raise its quality. It can structure it to bring out its essentials, analyze it to test its completeness, and filter it to eradicate inaccuracies, contradictions, and irrelevancies. The leadtime can be further reduced.

[1] U.S. Congress, Technical Information for Congress, Report to the Subcommittee on Science, Research, and Development, Committee on Science and Astronautics, U.S. House of Representatives, 91st Congress, Prepared by the Science Policy Research Division, Legislative Reference Service,Library of Congress, Committee Print, Washington, D.C., April 25, 1969, pp 521.

> Anticipatory studies by a capable staff can identify technical issues technical issues likely to require future resolution by the Congress. The collection of reliable factual information about such potential issues can take place in advance, uncolored by political controversy, and unhurried by the pressures of urgent need...

On the face of it, the need of congressional committees for sound scientific and technical information is obvious and hardly needs embellishment, so why write 521 pages to accent the need? There are good reasons advanced in the preface, and there are others, of course. One major problem is that issues with a technical content come to the attention of Congress as a result of (or in connection with) a sensational news story, event, or episode, as Huddle points out. This was true in the case of the AD-X2 (journalist's story), Camelot (newspaper disclosure), Mohole (the initial success), Salk vaccine (the TV announcement), Thalidomide (newspaper story), and Pesticide controversy (Rachel Carson's book). Trying to make a political judgement involving technical content during a period of heightened sensationalism is most trying. Another problem arises when "outstanding personalities" are selected as witnesses. Their views many happen to be more opinion than fact, if they are operating in areas outside of their expertese or have become emotionally involved in an "issue." Huddle developed a list of technical information-gathering methodologies useful for the Congress, such as: congressional requirements for technical information, ways to secure information pertinent to the issue, assuring authoritative, accurate, objective, technically sound information, and other helpful suggestions.

In addition to the cases mentioned above, he also explored such other cases as: high-energy physics, resource research (coal), behavioral research (social science in NSF) criteria for water projects, Peace Corps issues, Test Ban, and others.

The information scientist will also find this Committee Print of extraordinary value, dealing as it does with the complex needs of Congress for technical information, when it is needed, in what form, how to evaluate it, and how the technical information combines with other important sources of information and data. It is clear that the Huddle report has not been given the attention it warrants by the STI scientists and managers. This oversight needs to be rectified.

During the early 1970s, Dr. Amitai Etzioni, then a professor of sociology at Columbia University, became a member of the Science Information Council, National Science Foundation. One reason for his selection, perhaps, was an article he wrote on Congress and information a couple of years later.[1] Etzioni made a few observations in his paper that parallel those of Franklin P.Huddle. Etzioni's compass is somewhat larger than Huddle's. Highlights are provided because of the importance of the subject and the need for better understanding of the need and value of information, including scientific and technical information,in the legislative and decision-making process. Etzioni sees the key issue the mechanisms available to the national legislature to update its knowledge, recognizing that knowledge about society is inevitably colored and that the slant of and the access to knowledge is affected by the distribution of resources used in its production and processing. He asserts that the question of how a society "learns" does not concern "pure" scientific exploration but rather knowledge as it is applied in actual social situations where pragmatic considerations take priority. He accepts the views of Immanuel Kant and others that scientific knowledge is always incomplete and tentative. Revision is a continuous process. Interpretations are always needed to close the gap between knowledge available and that which a rational decision would require. He states:

> Scientific knowledge tends to be contained within comparatively abstract and specialized disciplines: it thus provides a highly fragmented picture of reality. Decision-making, however, requires synthesized knowledge and an inter-disiplinary perspective. Thus, science, per se, provides only limited help for the decision-maker who must find connections among the facts of numerous disciplines, each incomplete in itself.
>
> The canons of the applied world, as in the case of medicine, begin with the question, "Does it help?" not, "Is it true?" The precise way medicine X works may be unknown, but this is of secondary concern to the practitioner if it cures the illness.
>
> It is in the interaction between knowledge producers and consumers, as between social sciences researchers and societal decision-makers, that the knowledge is selected and adapted politically.
>
> The decline of legislatures in all Western democracies has been noted frequently by contemporary political scientists. This is the result of the rapid increase in the volume of the executive's activities without a con-

[1] Etzioni, Amitai, How May Congress Learn, SCIENCE, Vol. 159, January 12, 1968, PP 170-172.

> current increase in the legistature's capacity to oversee them...A similarly striking example is provided by the knowledge explosion. The executive, by far the largest knowledge consumer in the United States, uses millions of dollars worth of information to guide its vast, intricate network of activities. If legislatures are to examine these operations, their efficiency, and their rationale, they will require manpower and resources beyond their present supply. The basis of the problem is not, as it is sometimes said, that few members of Congress have scientific degrees; it would be neither practical nor desirable for Congress to rely for the evaluation of social problems and legislation on a member who, in his youth, gained a Ph.D, let us say, in sociology. Instead, the staffs attached to congressional committees are too small, insufficiently trained, and do not have adequate facilities to conduct independent analyses of the facts presented to Congress. Legislatures, at the present time, rely primarily on three sources for their information: the executive, parisans (interest groups), and unaffiliated experts.

Etzioni calls for larger staffs for committees and individual congressmen. The augmented staff should have research training. A major congressional research unit is needed in which information, mostly statistics, is gathered and stored in computers. Information produced would differ from what is provided by the Library of Congress, in that it would be more extensive, computer-operated and wholly research-oriented. Etzioni does not further clarify how this unit would differ from the Congressional Research Service. He recommends more funds for Congress to "farm out" research tasks. He believes that the informal hearing procedure should be replaced with a more vigorous one, so that witnesses will be more reluctant to give "stretched" interpretations, and be more inclined to arm themselves with valid information.

It would appear that Congress paid considerable attention to Huddle and Etzioni (and others), since it has in recent years increased the size of committee and member staffs, enlarged the size of the Congressional Research Service, and established the Congressional Budget Office, the Office of Technology Assessment, and the Congressional Clearinghouse of the Future. The comments about multidisciplinary information by both Huddle and Etzioni-information from diverse streams, and the need to temper virtually all information, including scientific and technical, in the process of making decisions, point to the need of more research in this field, research in multi-information source input and, insofar as practical, enriching the content of these diverse streams so that tempering and intuiting will be less required.

After blasting the Office of Science and Technology for not doing more to strengthen the Federal STI program in his address to the National Engineering Information Conference in June 1969, Congressman Daddario made another slashing attack on the Executive Branch about a year later.[1] Here is a summary of what he said:

> This country has seen a tremendous growth in the support of R&D since 1950. In 1950, the R&D budget was slightly over a billion dollars; in 1968, it has risen to more than $17 billion. We are now able to walk on the moon, use nuclear power to light our houses or destroy most of the human life on our planet. During the 1950s and 1960s, we talked about centralizing Federal R&D, but continued to create new agencies instead. Entering the 1970s, we face the gigantic task of efficiently and effectively managing the R&D enterprise. To achieve a better R&D management system we need improved policy-making in the executive and legislative brances. Clearly delineated lines of authority from policymaking centers down to individual benchworkers are needed. Improved coordination is also needed and not only to prevent duplication of effort. Overall planning is needed so that we do not lose sight of national needs while we focus on specific agency objectives. The present system of management is unsatisfactory in the Executive Branch where hardly anybody knows what is going on.It is worse in the Legislative Branch, largely because of the fragmented committee structure and the demands of time on the individual members. We have no overview of the Federal involvement in R&D. Proposals have been made for legislative reorganization including the formation of a Joint Congressional Committee, modeled on the Joint Economic Council. Nothing has happened.
>
> We cannot get the up-to-date information we need from the Executive Branch. The information systems we presently use in research management might be excellent repositories for historical information, but they are not useful for furnishing information for policy decisions. What we need is a "real time management information system for coordination and management of the Federal R&D enterprise." It would be desirable to relate basic and applied R&D in this system. DOD's proposal to set up an Independent R&D data bank is meritorious, but I think it ought to be placed in the Smithsonian Science Information Exchange. We ought to avoid duplicating information storage systems like we try to avoid duplication of research. It ought to be a real-time system. We need current data, not stuff that is 8 to 12 months old. We need data that agency middle management personnel would call proprietary, such as how decisions are made on what to support, what areas need emphasis, fiscal and other sensitive data. We believe that middle managers should have systems that help them generate the data that are needed and not have them work for the computers. We agree that controls have to be in place for proprietary data. The information in the system should not be "for someone else, not the middle management person. I hope arrangements can be made to share some of these data with the private sector. Ideally the system would be government-wide, include both R&D activity information, and contain both technical and fiscal information. Sound information practices are needed if the U.S. is to continue its preeminent position in science and technology. Although we have done well in the past changing requirements need new forms and administrative procedures.

[1] Daddario, Emilio Q., Information Systems and the Management of Research, Address to the Information Industry Association 3-day seminar in Washington, D.C. March 23, 1970, approximately 8 pages. The presentation was inserted in the Congressional Record, April 7, 1970, pp E 28842-E 2886.

So Daddario's earlier call for better STI programs was matched by a similar plea for improved R&D management systems, for more advanced R&D policymaking capabilities in Congress and the Executive Branch and for avoidance of duplicative information systems. Those knowledgeable about Federal R&D and STI systems will quickly agree that hardly any gains have been registered in the intervening years, but the Federal R&D budget has continued to climb, more than doubling since 1970. Again, it raises the question: has the failure to improve information systems that support Federal R&D contributed to declining productivity and innovation of R&D?

At the 1971 Fall conference sponsored by the Aerospace Research Application Center (ARAC) at Indiana University, Congressman J. Edward Roush of Indiana was called upon to make a presentation on the subject Consumers of Information. Unfortunately, Rep. Roush was unable to attend because of key votes scheduled in the House. Fortunately, the paper was printed in the Congressional Record.[1] Here are some excerpts from a very interesting paper:

> NTIS and other agency disseminators do a valuable service, but they do not answer all our needs. What we need, I am convinced, is a single agency, an independent agency, that collects all the information from all these diverse sources, stores that information, organizes that information, contracts for help in developing information, discovers what the needs are throughout the nation and brings together industry or educational insitutions or communities or hospitals with the newly minted technology or with technology that that is potentially usable. At present,there is a serious overlap which can also lead to omissions. And at times actual contact is never made between those who have access to the new information or technology within the government and those on the outside who do not even know it is available, or have not identified their own problem enough to make use of new methodologies which they do not know exist. The result is waste of knowledge of our important technology resources and non-development of potential customers.
>
> It is for these reasons that I have introduced H.R. 9379, to create an Office for Federal Technology Transfer, which I hope will accomplish a unification of these technology utilizationefforts and provide a "single point of contact" that the Senate Committee discussed,a point of contact not only at which all governmentsponsored information is accessible, but easily so, with information assistance provided out in the field.

Rep. Roush states that he had hopes that the Office of State Technical Services of the Department of Commerce could grow into this kind of an organization, but this program,

[1] Roush, Edward J., Consumers of Technology, Congressional Record Extensions of Remarks, November 18, 1981, pp E 12376 - 12378.

though well thought of and flourishing in most of the states where centers had been established, came to an untimely end. And though Roush's bill was also well thought through, also came to an untimely end. The major difficulty with the proposal, it should be revealed, was that it would create a superstructure organization without doing away with agency programs, raising the question about costly duplication. The bill was not pushed hard enough to attract other sponsors and a strong constituency.

In 1971, a bill, H.R. 8732, to establish a National Research Data Bank, was offered by Congressman Collier for action to the Committee on Government Operations. The purpose of the Data Bank was to have it act as the central national depository for all information and data relating to research programs,scientific and nonscientific. The Data Base was warranted, according to the sponsor, because of the possibility of duplication, waste and inefficiency. The bill called on the Comptroller General to establish and maintain the system. Annually, the Comptroller General would publish a catalog containing a summary of all information and data stored in the Data Bank, except for information that the President feels should not be disseminated to the public for reasons of national security. The propsed Data Bank suffered the same problem that the Roush bill did, i.e., it was superimposed on the myriad of programs carried out by the current array of agency and government-wide information systems already in place, programs that would not be removable because of agency missions and other public laws. The notion of having this kind of a center operating under the Controller-General made very little sense to the managers of Federal agency STI programs. Undoubtedly, the Comptroller-General felt the same way. The filing of the bill did reveal the kind of frustration that Congressman Daddario expressed in his talk to the Information Industry Association, a deep-seated belief that the Federal agencies were falling behind in their information processes involving R&D.

Another Congressman who recognized the importance of STI was Representative from Missouri, James W. Symington, who was also well known during the 1960s and early 1970s for his involvement with research and development matters in the House of Representatives.

In this round-up of figures in Congress who were anxious to see improvements in Federal, national and international STI handling and flow, Representative Symington deserves mention. An example of his views was printed in the Congressional Record. A summary follows of his comments pertaining to STI:

> The pace of scientific information and application has increased at an exponential rate since the 18th century, especially since World War II and the advent of sophisticated information systems...Science and technology are inextricably bound to the social and economic fabric of modern society and the effects which their development has on society are so great that they can no longer be permitted to evolve at random or suit the needs of isolated interests...Recognizing the crucial need for more knowledge and careful assessment of those impacts before we vote our decisions, the House voted in February to establish an Office of Technology Assessment -- to provide us with adequate information for managing science and formulating a rational science policy for our nation...Parliaments must provide themselves with operating methods and structures and up to date information systems so that the members are fully aware of the import of the decisions they must make.

The recommendations of the Third Parliamentary and Scientific Conference of the Council of Europe included:

> Encouragement of intergovernmental and international scientific and technical organizations.
>
> Facilitation of the movement of scientists and scientific instruments for the participation in programs developed by governments or international institutions.
>
> Establishment in cooperation with the Organization for Economic Cooperation and development, a data bank "designed to identify the described current research in Member States of the OECD and the Council of Europe.

During the time that has elapsed since the speech was made by Symington, the Office of Technology Assessment has matured, but it has not reached the point hoped for by Symington. The present climate does not favor the growth or support of intergovernmental and international scientific and technological organizations. The facilitation of the movement of scientists is not being encourageded by the U.S. government and probably others. The current research data base has not materialized; moreover, the U.S. government counterpart at the Smithsonian Science Information Exchange has been terminated and the responsibility has been transferred to the National Technical Information Service without personnel or funds to operate it. Ironically, it was about

[1] Symington, James W., Report to the House on the Third Parliamentary and Scientific Conference of the Council of Europe, Lausanne, Switzerland, Congressional Record, August 18, 1972, pp E 7587 - E 7589.

one year after his report that the science advisory and Federal R&D coordination apparatus was cast out of the White House by President Nixon; thus the reign of COSATI came to an end and the total Federal STI program began to unravel. The event undoubtedly came as a blow to the member countries in OECD and the Council of Europe, who came to expect that the United States would continue to bring strong leadership to the world of science and technology.

In the Spring of 1973, the House Subcommittee on Foreign Operations and Government Information held hearings to examine the role of the Federal Government with respect to the information explosition being sparked by by new electronic technology. [1] The Subcommittee chairman was Rep. William S. Moorhead, who opened the hearings with these remarks (summarized):

"Our general focus will be on how vastly expanded information and communications systems might be utilized to improve the full range of public information services provided by Federal agencies. Some hold that a revolution in communications is already upon us. Others advise that some of the most dramatic aspects ... are about to be revealed. Today, we will begin with a look at the technology itself, as seen by four expert witnesses." The first witness was Dr. Robert M. Fano, Associate Head, Computer Science and Engineering, MIT, who among other things, said:

> Communications technology has extended the range of our senses by enabling us to reproduce at a distance printed text, then sound, and finally pictures. The much older technology of printing had already enabled us to record, and transmit over time our collective knowledge, and to provide convenient and widespread access to it....Distance and time are no longer serious limitations; instead communication within society is primarily limited by the ability of people to identify, comprehend and utilize the information available to them.Now it is the human mind that needs to be extended...Society may not be able in the future to provide for itself the necessary knowledge-based seervices in the present manner. We must develop means of increasing in a major way the productivity in this sector of our economy. We must also enable individuals to do more for themselves, by utlizing more effectively the knowledge that is, in principle, accessible to them...With respect to knowledge-based services, we are still at the artisan stage. Their average quality is far from satisfactory, and still their availability is inadequate, or equvalently, their cost is excessive. What is needed is mass production of services, that is, a way of providing services that utilize the total knowledge and

[1] U.S. Congress, Federal Information Systems and Plans - Federal Use and Development of Advanced Information Technology (Part I), Hearings before a Subcommittee of the Committee on Government Operations, 93rd Congress, April 10 & 17, 1973, pp 217.

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> capabilities of society, in addition to increasing sustantially the overall productivity. For this purpose, information, instead of matter, must be transported and brought to bear on a specific situation, where and when and when the need arises. Thus a widespread and economic computer-communication network is clearly essential to the mass production of services, just as a widespread and economical transportation network has proved to be essential to the mass production of goods...This does imply that all such networks must be interconnected, and their users must be largely unaffected by the internal structure of the overall system...Real limitations stem from the present state of our software technology. We do not know at this time to impelement practical knowledge-based systems of the type that I have suggested. The development of software is still an art, rather than an engineering discipline.The cost of producing software is inordinately large and the probability of failure is discouragingly high...While a few While a few systems exist in which access to individual files can be granted and withdrawn selectively, the vast majority of computer systems do not permit even this basic form of control. Yet much more elaborate forms of control are needed, including means for controlling and auditing the controls themselves, according to externally established lines of authority and responsibility. Finally, I would like stress above all, and I really mean it, the tremendous importance of making computer-communication systems truly accessible and useful to the entire population...Knowledge when restricted to any particular segment of society, inevitably becomes power on the part of that segment over the rest of society.

The thoughtful words of Dr. Fano were followed by similar inputs from other witnesses, who were: Professor Marvin Adelson, University of California (Los Angeles), Donald L. Bitzer, University of Illinois, Donald P. Buckelew, Battelle Memorial Institute (Columbus, Ohis), Professor O.E. Dial, Long Island University, Herbert S. Dordick, New York City, Weston E. Vivian, Ann Arbor, Mich, and Professor Paul Zukin, University of California (Los Angeles). Like some of the other documents reporting on hearings held before various committees of Congress, this one is full of valuable insights, descriptions and predictions. It is recommended for the libraries of information scientists and information-communication policymakers in Congress and other sectors of government. Fano's recognition that those who are restricted from information suffer a loss of power as compared to those who have access to knowledge is a constant reminder that everything that can be done to minimize the problem needs to be done, especially in a country that prizes its status as a democracy. In an allegorical sense, the search for God, for the Holy Grail, and for productivity are representative of the search for knowledge and with it the achievement of power. Compunications - the marriage of computer and communication - changes the nature of the tools that now must be used to gain or maintain knowledge power.

In 1974, the Subcommittee on National Security Policy and Scientific Developments of the House Committee of Foreign Affairs, issued a committee print [1] as part of an extended study of the interactions of science and technology with United States foreign policy. The author of the paper, the twelfth of a series, was Genevieve J. Knezo, an analyst working under the direction of Dr. Franklin P. Huddle and Warren R. Johnston of Science Policy Research Division. The study examined major Federal programs which sent abroad nongovernmental U.S. scientists and technical personnel to lecture, study, conduct research, or attend scientific meetings. In the Foreword, Congressman Clement J. Zablocki, chairman of the Subcommittee on National Security Policy and Scientific Developments stated:

> This study analyzes the interaction of fereign policy with the origins, administration and effectiveness of scientific exchange programs. The recent proliferation of exchange programs and the increasing importance of science and technology as components of international relations underline the timeliness of this study. . .One conclusion to emerge is that both scientific and diplomatic objectives may be enhanced by better interagency coordination, program plannning and setting of priorities. ...Specifically treated are the senior Fulbright-Hays program; exchange programs administered by the National Science Foundation; and inter-Academy exchange programs with the Soviet Union, Eastern Europe, and the People's Republic of China, administered by the National Academy of Sciences-National Research Council.

The report is remarkable in a number of ways. First, it shows how different the climate for international interaction was only a decade ago; it reveals how unorganized and disorganized were matters dealing with international science policy; it shows a lack of concern for gathering and disseminating STI on the part of the thousands of nongovernment scientists and engineers who have participated in the program in the decade that started with 1960; it illustrates how poorly the overall program was managed and coordinated; and the recognition of the truth that international scientific cooperation is important to peace and understanding among nations. Based on what has been happening in recent years, it would appear that the conclusions and recommendations of the study have received little or no attention.

[1] U.S. House of Representatives, U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange, prepared by the Science Policy Research Division, Congressional Research Service, Library of Congress, April 1974, pp 163.

Not long after this report was issued, members of both the House and the Senate sponsored a bill (S.3716 and H.R. 15680), the International Science and Technology Act of 1974 or the International Science and Technology Tranfer Act of 1974, as it was also called. The purpose of the bill was to facilitate the transfer of science and technology to the developing countries and increase cooperation between the United States and other countries through the full utilization of global telecommunication services. As described by Senator Abourezk, the legislations would: [1]

> Establish an international institute to mediate the transfer of information by identifying what technology is available, by arranging for its distribution, and by assisting in establishing communication centers for receiving STI in the requesting countries. In addition, the institute would provide technology assessments connected with the use of informa-on particular subjects. The activities would be carried out under the guidance of an interagency council, representing every U.S. agency which has substantial foreigh and technological responsibilities.

In introducing the House version of the bill (H.R.15680),Representative Richard T. Hanna of California stated: [2]

> Telecommunications has reached such a sophisticated level of development that it should be used as the basic facilitating device for global technology transfer...(This) will greatly aid in bridging the gap between the "haves" and the "have-nots." With continued refining and honing I believe that this bill will meet the challenge of establishing a really effective global information and technology transfer system...H.R. 15680 provides a structure for facilitating technology transfer to the developing countries, a structure which has its parallel in the early U.S. experience when we provided such facilitating structures as our Land Grant Colleges and the Community Agents Network. We need these revised, updated and innovative new organizational structures to channel man's effort in a more organized and effective way.

During this period, Senator Abourezk introduced a bill to establish the Earth Resources Observation Administration to better exploit the information that satellites were producing. Senator Humphrey had also introduced two bills calling for the establishment of a Solar Research Center that would bring a number of nations together in a common program to produce new and needed knowledge. Hindsight reveals that none of these bills to improve sharing of STI through old and new technology went anywhere.

[1] Congressional Record, Vol. 120, No. 95, June 27, 1974, Proceedings and debates of the 93rd Congress, Second Session, introduced by Mr. Abourezk.

[2] Congressional Record, Vol. 120, Nol 96, June 28, 1974, Proceedings and debates of the 93rd Congress, Second Session, Although the bill was introduced by Mr. Hanna, other Congressmen were involved (Brown, Cronin, Derwinski and Winn)

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One of the STI stalwarts in the House of Representatives was Congressman Olin E. Teague, chairman of the Committee on Science and Technology. One of his concerns dealt with "wasted" scientific data and poor information management. On one occasion, he was asked to prepare a guest editorial for the Pittsburgh Press on the subject. This was reprinted in the Congressional Record by Representative Gary A.Myers of Pennsylvania, a fellow member on the Committee on Science and Technology. [1] Said Mr. Teague:

> Abundant evidence has shown that information management today is resulting in wasteful neglect of available knowledge and the funding of needless research to repeat findings already in the literature. This waste is no longer tolerable. Some students of the future predict that national strength in the next century will be determined by the skill with which the nations of the world manage their information resources. This is not hard to believe. We were fortunate, for example, in World War II that the scientific information was so badly neglected in Germany that its considerable advantage in early atomic science never won credence in the upper reaches of the Nazi government.
>
> Sometimes we in Congress in our efforts to promote efficiency and economy, have tended to constrain the dissemination of STI by government agencies; this is a clear example of penny-wise, pound-foolish. When we pay millions for a piece of research, we should be willing to pay a sufficient fraction of that amount to insure that the fruits of the investment are fully utilized.

A few weeks later, Representative Teague inserted an item dealing with data in the Congressional Record. [2] The article dealt with how NASA made scientific and technical information available through its Office of Technology Utilization to link it to the needs of private enterprise. The program and the products it provided was described by Mark Stevens, the author. Throughout his stay in the House, Representative Teague demonstrated his interest in science communications in a positive manner.

The subject of protection of personal information was of great interest to Congress during the 1970s. An example of this interest is revealed in the sudden emergence of Sam J. Ervin, Jr. of North Carolina as the champion of many individuals and groups

[1] Congressional Record, March 18, 1975, p. E 1241.

[2] Congressional Record, May 8, 1975, Space Data Available to Solve Problems, Inserted by Hon. Olin E. Teague of Texas.From an article in Small Business magazine by Mark Stevens, p. E 2300.

who felt threatened by the advance of computers and the potential misuse of these "monsters" that would rob them of their liberties. Here is what Senator Ervin stated in the preface of a staff report on the subject: [1]

> The growth and intensity of surveillance of Americans during the last two decades gives cause for contined alrarm. Despite the real benefits to flow from the Privacy Act of 1974, a broad agenda for action faces the Congress. The gradual chipping away of individual liberty has been amply demonstrated in hearings and reports. Even as the 94th Congress prepares to assemble, new evidence of political surveillance has been reported. The Congress is charged with protecting the fragile rights of individuals - against a pervasive new electronic technology and overzealous practitioners of data assembling and application techniques...This study should serve to embellish the already plentiful literature prepared by Congress. Let us in America continue to be in the vanguard of nations striving to protect human liberties.

Of course the goal sought by Ervin is admirable and there is hardly any doubt that the work of his committee and others in Congress was of great value in warning the nation that the negative effects of the computer and data bases had to be understood and protective measures erected. That literature on the subject had become plentiful was an understatement. The work of his committee received considerable and loving attention from the press. Ervin, whose actions up to that time in the Senate had been unspectacular, suddenly became a media hero. What was irking to many persons in the Executive Branch of the government were statements made by Ervin that would lead citizens to conclude that the Executive agencies were joined in a cabal to deliberately deprive citizens of their privacy. Organizations in the Executive Branch were working on the subject in the 1960s. An example is the program of the Committee on Scientific and Technical Information of the Federal Council for Science and Technology. This was the Panel on Legal Aspects of Information Systems, whose report in the early 1970s is described in another portion of this book devoted to the work of COSATI. The Domestic Council, Executive Office of the President, had assembled a task group on the subject of privacy that operated under the direction of Quincy Rodgers, a legal expert on the subject. The media gave no attention to Executive Branch privacy protection programs,

[1] U.S. Senate, Privacy and Protection of Personal Information in Europe, Privacy Developments in Europe and Their Implication for United States Policy, Committee Print, 93rd Congress, 2nd Session, a staff report of the Committee on Government Operations, U.S. Senate, March 1975, 436 pages.

relatively. Notwithstanding the feeling of anxiety experienced in the Executive Branch, the work of the Congress in establishing legislation to protect the privacy of individuals has to be considered timely and excellent. One can even agree that the "dog and pony show" that went to Europe made a useful contribution. It was an intense learning period and an acknowledgement of the importance of information technology in modern day society. Much valuable documentation is to be found in Privacy and Protection of Personal Information in Europe that explores, not only the field of privacy, but the dimensions, impact and augery of the Information Age. It may come as a surprise to information scientists and others that COSATI had been studying the impact of information technology and the information explosion on the law covering copyrights, patents, antitrust legislation, freedom of information as well as privacy of the individual.

On March 6, 1975, a bill was introduced in the House, dealing with science policy and organization.[1] About the legislation, Mr. Teague said:

> I have introduced with the cosponsorship of the ranking minority member of the Committee on Science and Technology,Mr. Mosher, a bill entitled "The National Science Policy and Organization Act of 1975."...It comes after five years of comprehensive investigation and study...In summary, the bill seeks to accomplish four things:
>
> 1. It endeavors to enunciate a well-rounded national science policy.
>
> 2. It would establish a Council of Advisers on Science and Technology in the Executive Office of the President - but with specially built-in discretionary powers to use and organization vested in the President.
>
> 3. It would provide administrative unity and coordination of the essentially "R&D" agencies of the government, as well as government-wide oversight and budget review of "R&D" activities, through the innovation of a staff-function, cabinet-level Secretary of Research and Technology Operations.
>
> 4. It would undertake to consolidate and make compatible the operations of the various Federal science information agencies by merging them into a single government corporation with special ties to the private sector.

The organizations that were mentioned in Title III of the proposed statute were: the National Bureau of Standards, the Weather Bureau, the National Oceanic and Atmospherice Administration, the Atomic Energy Commission, the National Science Foundation, the

[1] U.S. Congress, A Proposed National Science Policy and Organization Act of 1975, Committee Print, Prefaced by Olin E. Teague, Chairman, Committee on Science and Technology, U.S. House of Representatives, 94th Congress, 1st Session, March 6, 1975, pp 61.

National Aeronautics and Space Administration, and the Energy Research and Development Administration. Title IV would add one more agency:

> This is an institution to provide a service which has been repeatedly sought by Congress since at least 1950. It is a plan for a corporation to insure the fullest possible use of the STI generated at public expense. The reason for this Title is to assure that such information should not gather dust in the files, but should be put to use as promptly and as efficiently as possible. Moreover, the nature of the information process is such that it requires close cooperation between government and private entities. Thus the corporation is directed to establish close liaison with all pertinent elements of the private sector. Abundant evidence has shown that information management today is resulting in wasteful neglect of available knowledge and the funding of needless research to repeat findings already in the literature. This waste should not be tolerated.
>
> Some students of the futre predict that national strength in the next century will be determined by the skill with which the nations of the world manage their information resources. This is not hard to believe. We were fortunate, for example, in World War II that certain scientific information was so neglected in Germany that its considerable advantage in early atomic science never won credence in the upper reaches of the Nazi government. The biggest development in the glass industry in the past 50 years - the glass float process- was based on an American patent, but it was developed in England. The patent was ignored in this country for more thanhalf a century. The Kroll Process for producing titanium was similarly neglected for nearly 40 years.
>
> Sometimes we in Congress, in our efforts to promote efficiency and economy have tended to constrain the dissemination of STI by Federal agencies. But this is a clear example of penny wise, pound foolish. When we pay millions for a piece of research, we should be willing to pay a sufficient fraction of that amount to insure that the fruits of the investment are fully utilized.
>
> The rational of Title IV is that scientific information management is recognized by the Congress as a vital part of the whole scientific and technological process. It must efficiently be carried out...

As the reader will recognize, neither the Department of Research and Technology Operations nor the Science and Technology Information and Utilization Corporation came to pass. The four entities that would have been transferred into the Information Corporation were: NTIS, SSIE, OSIS (NSF) and the Science Information Council, also of NSF. The latter, SIC, was eliminated through the device of Sunset legislation. SSIE no longer exists, its function passed over to NTIS without funds or personnel to operate it. NTIS exists through the sales of technical reports. The Office of Science Information Service, still called for by law, has been terminated. Congress at the time this book is being written has taken no action to save these organizations, despite the importance they place on better information management and use.

On June 2, 1975, Senator Edward M. Kennedy sent a letter of transmittal and a report to the Chairman of the Senate Committee on Labor and Public Welfare, U.S. Senate, Harrison A. Williams. At the time, Senator Kennedy was the chairman of the Special Subcommittee on the National Science Foundation. The report [1] was prepared at his request by Robert L. Chartrand and Rosemary A. Chalk, both of the Science Policy Research Division, Library of Congress. This report is considered one of the key reports on the subject of Federal science communications. In his letter of transmittal Senator Kennedy said:

> In the past few years, the Special Subcommittee on the National Science Foundation has examined some of the particular issues surrounding our structures for research and development, and the complex processes involved in transferring the products of government research into meaningful benefits for our society. The importance of STI has emerged previously in the congressional examination of science and technology organizations, but only recently have we become aware that international and industrial trends in information networks have enhanced the value of our scientific information resources. This new attention to information as a national resource, however, has also revealed serious weaknesses in our infrastructure for developing and utilizing this valuable resource...Our investigation into the budget reductions being imposed on the Office of Science Information Service and the abolition of the Science Information Council subsequently revealed an array of serious issues surrounding the management and support of STI...Before we make decisions that shape the future directions of Federal STI systems, the Special Subcommittee would like to receive recommendations from the scientific community and information specialists as to how these alternatives can best be acted upon...Ultimately, we hope to introduce legislation based upon our continued investigation which will provide for improved management and coordination to effectively handle STI.

The report, in the words of Lester S. Jayson, Director, Congressional Research Service,

> ..Examines the role of the Federal government, and in particular the National Science Foundation, in managing and monitoring STI activities in both the public and private sectors. It contains an overview of the conceptual and factual information essential to an understanding of this complex subject area, including a review of salient developments during the past two decades...(It also contains) a retrospective look at the full range of studies, policy-level decisions, and organizational actions affecting the evolution of the STINFO community in the period 1950-1975.

In their investigations, Chartrand and Chalk uncovered a considerable number of problems and weaknesses in the way that the NationalScience Foundation was discharging

[1] United States Senate, Federal Management of Scientific and Technical Information (STINFO) Activities: the Role of the National Science Foundation, Prepared for the Special Subcommittee on the National Science Foundation, Committee on Labor and Public Welfare, U.S. Senate, 94th Congress, 1st Session, July 1975, pp 103

legal responsibilities. They also found similar weaknesses and problems in the way the governmentwide STI program was being handled. Here is a sampling:

> As Science Adviser, Dr. H. Guyford Stever has inherited responsibility for guiding STI activities, but there is scant record of continuous initiative in this area. The Foundation has not shown much enthusiasm for pursuing the coordination and policymaking roles...
>
> Though given increased responsibilities, OSIS has had its budget reduced from $14 to $5 million, its staff from 70 to 22 persons.
>
> NSF took on responsibility for coordinating interagency efforts without a clear legislative mandate authorizing such action and without necessary funds or staff allocated solely to this role.
>
> Without carrot or stick, NSF is in a poor position to develop a policy-guided network of science information services capable of meeting national needs.
>
> In seeking to coordinate or rationalize the emerging network of government-operated science information systems and Federally-funded private services, the Foundation must carry out a role filled with ambiguity and bureaucratic restrictions.
>
> It is important to note, and of critical national concern in an age of great governmental and societal requirements for valid, up-to-date STI, that the management apparatus within the Federal government appears to be less sturdy and less dedicated to sustained oversight than a decade ago.
>
> STI policy oversight in the Executive Branch and in Congress has diminished despite its acknowledged importance and the growth of agency operating systems. New groups capable of generating useful perspectives have not been encouraged. Policymaking elements such as the Federal Council for Science and Technology have evinced only minimal interest in controlling duplication of effort in R&D projects or supporting those information products and services which could eliminate or at least minimize such overlap.
>
> A curious dimunition of attention to managing, monitoring, and applying the critical flow of STI is threatening the effectiveness of the Federal R&D program.
>
> Costs of the Federal agency STI programs are high, ranging between close to one-half billion dollars to possibly two to three billion dollars, and are expected to rise. Many agencies, it is alleged, have tended to become preoccupied with their own programs and resist cooperative endeavors..., resulting in a feudal posture which impedes the realization of national goals. ...In the absence of adequate guidelines and unequal Federal participation, the public good resulting from government-supported R&D could be diminished.
>
> The Senate Special Subcommittee on NSF will address the STI issue in response to charges of the existence of a policy vacuum" within the Federal government; the critical need for a coordinated policy approach; the lack of real top level support of existing STI programs;the dangers of weakening an already minimal service capability and the increased complexity and quantity of STI, outstripping the capabilities of existing documentation and analytical services.

Other problems are cited in international interchange policy, in a working relationship with the private information sector, and the absence of structures at high levels to monitor and coordinate an increasingly important national resource.

On October 31, 1975, Senator Kennedy wrote to Dr. Stever, the Director of NSF and the acting Science Advisor to the President, asking him to review the Chartrand-Chalk study and make any suggestions he deemed necessary. In his letter [1] Kennedy wrote:

> It is our intention to move as promptly as possible in making our recommendations and in planning a legislative program to improve the management and coordination of STI. I look forward to the Foundation's participation in this effort.

An answer was sent to Kennedy by Stever, November 21, 1975,[2] which is summarized as follows:

> The report presents an accurate review and thoughtful analysis of the management of federal STI activities...I agree that it is time to reexamine our national arrangements for improving access to the results of R&D. We have begun to do so within the Foundation. During the past year I held separate discussions of STI issues with representatives of scientific and professional societies, profit seeking firms, and senior federal managers of STI services. At my direction, OSIS also surveyed federal STI policies and practices. Results to these analyses are being used to clarify the role and strengthen the activities of OSIS... Also when appropriate, I intend to recommend to the Director of the pending Office of Science and Technology Policy that this office review the present arrangements for formulating and implementing national STI activities, guiding their interaction with private services, and for stimulating greater investments in these activies by the private sector. I shall be pleased to work with you in improving the management and use of STI.

It came to pass that Senator Kennedy did not get an overwhelming response from those he sent the report to, one reason probably being the way the mailing was handled and who received copies of the report. Whatever the reason, Kennedy appeared to lose interest in the study and the overall problem. This cynical approach seemed to be beyond reason, based on the phalanx of problems and issues that Chartrand and Chalk reported. Kennedy's turnabout is still unanswered today. On the other hand, what Stever did to improve the NSF program, quite apart from the total Federal agency problem, did not equal what he said in his response to Kennedy. The Office of Science Information Services of NSF continued on a downward spiral. If he spoke to the incoming Director of OSTP, Dr. Frank Press, about the study called for by Senator Kennedy,

[1] Kennedy, Edward M, Letter to H. Guyford Stever, Director, NSF, October 31, 1975, U.S. Senate, Committee on Labor and Public Welfare. 1 page.

[2] Stever, H. Guyford, Letter in response from the Director of NSF, November 21, 1975, 2 pages.

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and what OSTP might do in the future, there is no record. This outstanding study undertaken by Chartrand and Chalk that took months of hard analytical work disappeared from view. To a measure, the recognition by the OSIS staff and the STI managers of other agencies that nothing was going to happen was a severe blow to their morale. Presumably, the authors of the study were disappointed in the outcome, but there was little they could do.

At this point, the author finds it necessary to make some remarks about Robert Chartrand, the senior information expert of the Congressional Research Service. For more than two decades, he has interacted with the managers of the Federal STI programs in a positive, cooperative way. He has been one of the forces that have combined to push the Congress into a modern information-handling capability. He has worked on the preparation of legislation involving information, computing and communications. He has been a prolific writer on such subjects as: Federal information management policy, the legislator as a user of information technology, directions for the Congress in information support and program budgeting, the potential of information technology in congressional acitivity, information science in the legislative process, computer-based information systems and services for rural America, the use of computerized information serices available to Congress, and optimizing the value of U.S. STI and legislative options. He has made innumerable talks on STI and Congress to professional societies and trade groups. He has acted as an advisor to congressional committees. He has been a lecturer in many countries and has written hundreds of books and papers that appeared in publications in the United States and abroad. On many occasions, he has been called the foremost information expert in Congress. He has sponsored many symposia in Congress and professional circles on information matters - congressional, Federal, national and international. He has worked closely with COSATI and its successor, the Federal Information Managers group. Perhaps, more than any other person working for Congress, Chartrand has been a strong advocate for improved information programs. His unmatched knowledge of the field which is evident in his 1975 study has made him a congressional and national resource. With credentials as excellent

as these, the failure of Senator Kennedy and Dr. Stever to use the study to require action to improve matters in the Foundation and in the Federal agencies is sad. They missed an excellent opportunity to achieve progress. The recommendations in the study still cry for implementation.

In the bicentennial year 1976, the American Society for Information Science, held a conference in Washington,D.C., on the theme: America in the Information Age. A number of members of Congress participated and made speeches, among them: Congressman John Brademas, Senator Edward Kennedy, Senator Hubert Humphrey, Congressman Brock Adams, Congressman Charles Rose, Congressman Gillis Long, CongressmanRobert McClory and Congressman William Steiger. Some of what they had to say follows:

Senator John Brademas, charged with making the opening remarks, stated:

> What we need is operative access to relevant intelligence which includes: first, the capacity to get at what we want. The storehouse of knowledge at the Library of Congress is of little use if we can't get at it; second, our access must be reasonably easy, not in a theoretical but in an operative way; third, the information must be relevant for our purposes, not everything on a particular subject; and fourth, we want more than information, we want intelligence - facts with some sense of structure and meaning. The capability for operating access to relevant intelligence is far more important to the future place of Congress in the American constitutional system than many of us in Congress realize. To cope with the number and complexity of presently identifiable and future public policy issues, we must creatively utilize the developments of modern information technology. Congress' success in harnessing the technology to our needs will determine, in large part, our capacity as an institution to analyze and evaluate both existing programs and proposed policies as well as to improve communication between individual members of Congress and other government institutions - Federal state and local - and between Congressmen and their constituents. Beyond the legislators need to know more if they are to write sound policy, there is another and more profoundly important consequence of the proposition that knowledge is power. Access to intelligence has the deepest consequences in a mod- constitutional democracy like ours for the relationship between the Executive and Legislative Branches...I salute ASIS on your leadership in making this meeting possible. For what you do here is far more important for the future of our country than even you may think.

The next day, April 13, 1976, the attendees heard Senator Edward M. Kennedy make an address on Information and the Future. [2] Here are some of the highlights of his talk:

[1] Brademas, John (D-Ind.),Opening Remarks to Conference on America in the Information Age, sponsored by ASIS, April 12, 1976, Washington, D.C. (copy of Brademas'script) 9 pages.

2.Kennedy, Edward M., April 13, 1976, copy of script furnished by Kennedy's office. 5 pages.

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> America is immersed in an ocean of information, which we must learn to channel toward human purposes. The information explosion in recent decades has shattered society even more than the splitting of the atom. Studies have shown that the average scientist spends over half his time in various forms of communication. This leads to the publication of over 30,000 journals, with over 1 million scientific papers each year. There are over 300 abstract journals and over 400 specialized information centers. We are literally inundated with information. In the Executive Branch there are thousands of special programs, involving conflicting mandates and missions, with little coordination among departments, or even within agencies. In industry, the spectacular increase in the use of the computer has made the control of information the key element in management strategy. Today, we live in an age of information. Upwards of half of the U.S. workforce are engaged in knowledge-producing or dataprocessing activities. The information explosion poses both great problems and opportunities in the law, the economy and in society at large. ..How do we design and manage a national information network, in partnership between government, universities, industry and the public?
>
> Modern information science opens the prospect of a return to the New England town meeting approach on a national level. This is the most exciting prospect I know for strengthening our democratic system.
>
> We must recognize that information is a major national resource - and that we must plan, conserve, and manage its utilization. To do this we must establish an information Magna Carta. spelling out the relative rights and responsibilities of the Government, industry, and the individual in dealing with this information resource.
>
> By early May, the national will have a White House Science Office, and the President will have early access to top-level scientific advice. The (enabling) Bill highlights information handling and dissemination. The President's Advisory Committee is given the task of conducting a comprehensive survey of federal science and technology, including consideration of improvements in existing systems for handling STI on a government-wide basis, with consideration of the appropriate role to be played by the private sector. The Bill also establishes as national policy that it is the responsibility of the Federal Government to promote prompt , effective, reliable, and systematic transfer of STI; and to facilitate the close coupling of scientific research with the commercial application of the useful findings of science.

Senator Kennedy then discussed the study undertaken by Chartrand and Chalk the previous year. He said:

> This report examines the lead role of NSF in the management of federal STI. It proposes the establishment of a STINFO panel reporting to the President's science advisor to monitor and evaluate STINFO programs, taking account of quality, costs, and competition, as well as user needs. The panel would also foster STINFO R&D, and develop policies designed to ensure reasonable balance between federal funding of government and private sector information services. As soon as the new White House Science office is in being, I intend to request its review and recommendations regarding this report.

The Senator discussed the new Office of Technology Assessment program whi ch will engage in a continuous assessment of national R&D policies and priorities, including consideration of STI.

Nothing was said about the substandard job in the STI management and coordination area at NSF and the Federal agencies or that he was going to seek progress at that level.

Nor is there any information about the discussion, he promised, with the Science Advisor when the latter came aboard. It will be remembered that Dr. Stever also promised to discuss the matter with the Science Advisor when his office became established. It is quite possible that both Kennedy and Stever discussed the matter with Dr. Frank Press when he became Science Adviser. If so, they failed to persuade him.

Returning to the ASIS Bicentennial Conference, Senator Hubert Humphrey is the last member of Congress whose observations will be summarized. After he acknowledged his appreciation to a standing ovation by the audience, Senator Humphrey said: [1]

> As our Nation begins its 3rd Century, the tasks and responsibilities of national and world leadership multiply more rapidly than ever before. The challenges of the future can be met only through effective use of information and the varied capabilities of its technology. Above all we need to remember that the most vital vactor in this process is people. President Johnson used to say: "A man's judgement is only as good as his information." This is the message we all need to remember in the age of the computer, mass media and instant analysis...Intelligible communication of vital information is the absolute foundation stone in building the structure of knowledge that leads to human progress. Failure to master the scientific revolution in information control contributes to unknown duplication and tragic, intolerable wastes of men, money, and material. Despite major accomplishments in the sphere of information, I regretfully find all too frequently that my criticism still stands. For example, the Federal government over the years has increased significantly its investment in biomedical research and in finding the causes and cures of major diseases. It has been by belief consistently that this investment should be multiplied. At the same time, however, the effective interpretation and transmission of the information gained from this widespread research remains an elusive goal. Moreover, we have not moved very far toward sharing this knowledge beyond national borders...Harsh facts remain -- widespread malnutrition, even starvation, and disease affecting major sectors of the world's population; and international scientific research communication too often is at a rudimentary level.

After discussing the need for a national food policy and supporting information to formulate such a policy, Humphrey switched to the need for effective and comprehensive analysis of complex statistical information, reminding the audience that he was the Chairman of the Joint Economic Committee, thus knew the requirement at first hand. He then lamented the quality of Congressional information and communications, stating:

[1] Humphrey, Hubert H., Untitled Speech, made to the American Society For Information Science Bicentenial Conference, Washington, DC., April 12, 1976. copy of script furnished by Senator Humphrey's offce, 4 pages.

"A 20th century Congress cannot be content with employing 18th century techniques." It must modernize and employ innovative methods to do its job of legislative oversight, program evaluation and making laws. He said he disdains the argument about the merits of small versus large government. What is needed, he stated, is better government. He called for improvements in health service, housing for the poor, a fair tax system, a good transportation policy, and a sound energy problem. All of these, he pointed out, need better information systems, requiring a national information policy that strikes a reasonable balance between the public's right to know and the individual's right to privacy.

Another Congressman who has been concerned with information and communication was Ray Thornton, who headed up the Subcommittee on Domestic and International Planning and Analysis during the mid-1970s. The Subcommittee held hearings on International Dissemination of Federal Research and Development Results.[1] In his letter of transmittal to the Chairman, Committee on Science and Technology, Rep. Olin E. Teague, Thornton wrote:

> The effective dissemination and utilization of Federal research and development results offers the nation a vast and largely untapped resource for addressing the problems facing government jurisdictions at all levels. Mechanisms for intergovernmental exchange of information and Federal assistance in the application of innovative technology developed from federally funded research has been the subject of extensive study over recent years, and there is a history of interest in this subject by our Committee. This interest was highlighted in 1972 by the co-sponsorship of a major conference "The National Action Conference on Intergovernmental Science and Technology Policy" held at Harrisonburg, Pennsylvania...The Subcommittee has conducted hearings and performed studies ...There still exists a need to move forward from studies of problems in public technology to the development of specific approaches which have the potential for legislative action.

The Subcommittee focused on three perspectives from which the potential utility of Federal R&D for solution of national problems are viewed:

> 1. Opportunities as perceived by individuals at the non-federal level of government to utilize and make appropriate adaptations of innovative techniques developed at the Federal level in non-federal jurisdictions.

[1] U.S. Congress, Review of Intergovernmental Dissemination of Federal Research and Development Results, Special Oversight Report No. 5, Subcommittee on Domestic and International Scientific Planning and Analysis, Committee on Science and Technology, U.S. House of Representatives, 94th Congress, July 1976, pp 45.

> fashion by pointing out that many of our States are of the same size as certain European countries, which on their own initiative and at their own expense do fund national technology transfer entities. (p.256)
>
> -- William T. Knox, Director, National Technical Information Service

As seen by a participant from the private sector, who substantiated the importance of STI to the States and localities and drew parallels between the public and private sectors:

> Of the approximately $32 billion spend on R&D activ ities in the U.S. in 1974, 42 percent of the total was spent by industry, and 53 percent was spent by Government. It is estimated that $4.6 billion was spent in 1974 by Government in its own R&D facilities and laboratories. Thus, in parallel with the industrial R&D sector, the requirement for STI exists in the governmental sector. (PP133-134)...Thus there must be governmental cooperation. At this time, in many areas, the various Federal, State and local systems are fragmented, even in those fields for which there are apparently parallel missions. The leadership initiative rests with the Federal agencies but for any coordination to be effective, it must be developed with the active consent and participation of all parties (pp 134-135)
>
> --Dr. Walter Grattidge, General Electric Company

The reader knowledgeable about the extent of current coordination between all of the users of STI will recognize that progress in intergovernmental sharing of STI has not been an unqualified success, although there are a few signs that the problem has not been forgotten. Congress has done what it can to encourage the Federal government to take a more vital role in technology utilization. Some gains have been registered, but progress has not resulted. One of the problems noted is that there is no evidence that the Executive Office of the President is willing to commit the resources to the program called for by the Subcommittee,including that of leadership and coordination. With one or two exceptions, Federal agencies have not attempted to coordinate their STI and technology utilization programs, let alone agreeing to implement the major recommendations of the Thornton Subcommittee. During the era of the Federal Council for Science and Technology, there was a Committee on Domestic Technology Transfer that operated under its aegis, but with the termination of FCST in 1973, this subcommittee disappeared. The drumbeat message of the current Administration is loudest in advocating that government operations be turned over to the private sector and/or quieter in transferring STI produced in government R&D programs over to the private sector (and non-Federal government sector). To some extent, NTIS is trying to provide Federal R&D knowledge to industry and government sectors, it should be pointed out, but this is a far cry from the hopes of the Thorntaon Subcommittee.

In the early days of 1977, Congressman George E. Brown (D-Cal) introduced a bill dealing with Science and Technology Communication and Information. More specifically, the bill was:

> To establish a science and technology communication and information policy for the United States, to establish a science and technology communication and information system...

Because of his disappointment arising from the evident lack of desire of the Director of the Office of Science and Technology Policy to pick up and implement those parts of the National Science and Technology Policy, Organization, and Priorities Act of 1976 that deal with scientific and technical information. Congressman Brown added a title to his bill that would require the OSTP Director to establish within OSTP, the Science and Technology Communication and Information Division. Obviously, OSTP pointed out that the small size of its staff and its budget made it impossible to undertake the STI responsibility. The bill sought to eliminate this excuse by providing a legislative base for staff and dollars for this function. The function of this office was to assist the Director in formulating policy and providing advice within the Executive Branch on science and technology communication and information. It would also monitor R&D in the private sector, assist OMB with an annual review and analysis of funding proposed by the Federal agencies, initiate studies and analyses dealing with resolution of critical and emerging national and international problems, and after making a periodic survey of national and international STI policy, make appropriate recommendations for needed actions.

A second title called for the formation of a science and technology communication and information institute, which would have the authority of conducting basic and applied R&D mainly through grants and contracts. It would also develop standards for device and systems performance in the field in cooperation with professional societies and industry. It would provide to other agencies technical assistance concerning the field. It would review other Federal R&D efforts and recommend changes where needed. Finally, it would promote operational compatability, integration, and uniformity among public and private information services. Several Federal programs would be transferred to the Institute: the Department of Commerce Office of Telecommunica-

tions and the Institute for Computer Services and Technology of the National Bureau of Standards.

A third title called for the establishment of a science and technology information service corporation, who mission it would be to assure the widest possible dissemination of STI to industry, labor, academic community, State and local governments, and to the public at large. Specifically, the corporation would coordinate, collate, publis, arrange, and manage such information to make it available rapidly and at the lowest cost to users.

It was not surprising that the bill was not enacted into law. While it was intended to solve a number of problems, it also created other problems, not the least of which would be the friction that would take place between the corporation and the agencies with R&D programs and mandates to disseminate the STI resulting from them. The notion of an information institute, which had been suggested by others earlier, did not receive general applause, although there was much merit in it. The title that would have strengthened OSTP's ability to create a formal STI program was regarded with happiness by the STI community, but it did not make the grade in the Executive Office of the President and in Congress. Congressman Brown has not accepted defeat of the bill which with some changes is proposed annually. It is a sad commentary that the Director of OSTP places such a low priority on a Federal program that may cost as much as $6 billion a year and that members of Congress have to keep the STI flag flying at full mast.

In the Fall 1978, a public law was passed by the Congress to authorize the permanent establishment of a system of Federal Information Centers. [1] P.L. 95-491 was passed October 20, 1978. It gave the Administrator of the General Services Administration the authority to establish within GSA a nationwide network of Federal information centers to provide the public with information about the programs and the procedures of the Federal government and related purposes. The authority included $7,000,000

[1] Reported in the ALA Newsletter, Flirt (Federal Librarians Round Table), Volume VII, No. 2, Winter 1978, p 3.

and such sums that were needed for each succeeding fiscal year for carrying out the purpose of the information centers. The Committee on Governmental Affairs, Senate, sponsors of the act told the GSA Administrator that in managing and further developing the national Federal informaction centers network, he should specifically examine the possibilities for coordinating and cooperating with the service provided by Federal agency libraries and Federal depository libraries. During the hearings, ALA had expressed its concern about possible duplication of effort between the GSA centers and the Federal libraries and depository centers. It also suggested that some of the information centers be located in the library facilities. GSA established a number of centers in cities across the United States.There is no evidence that they followed the suggestion of the Committee on Governmental Affairs. With the passage of years, most of these information centers that were established by GSA were discontinued. But it should be said about this era, Congress was very favorably inclined to support information centers and related programs. In the present climate, it would be difficult to have any Federal agency push for information programs and facilities, unless they were desperately needed and OMB agreed with that need.

The flame was not completely extinguished. In October 1978, the Subcommittee on Science, Research and Technology undertook a modest program to seek out legislative options in optimizing the value of U.S. STI. The Congressional Research Service was asked to prepare such a list at the request of Rep. Ray Thornton, Chairman of the Subcommittee.[1] In the Prologue of the report, Olin E. Teague, Chairman of the Committee on Science and Technology writes:

> The responsibility of the House Committee on Science and Technology, since its creation in 1958, has included oversight of R&D. One key aspect of this jurisdictional role has been the encouragement of both public and private sectors to produce and disseminate information derived from their R&D activities. The Committee in the past has also been active in promoting better understanding of the significance of managing information and knowledge effectively. We on the Committee recognize the increasing critical role that STI is destined to play in the years ahead...

[1] U.S. Congress, Optimizing the Value of U.S. Scientific and Technical Information: Legislative Options, Prepared by the Congressional Research Service at the request of the Subcommittee on Science, Research and Technology of the House Committee on Science and Technology, Washington, D.C.,October 1978, pp 20.

> Evidence has shown that information management today may be suffering from wasteful neglect of available knowledge and the funding of needless research with respect to findings already in the literature. This waste should not continue to be tolerated. In fact, some students of the future predict that national strength in the next century will be determined by the skill with which nations of the world manage their information resources. This is not hard to believe.

In the Introduction, it is stated that the purpose of the booklet is:

> To identify and underscore the opportunities for legislative action that would lead to maximizing the utility and effect of STI both on the national scene and in fulfillment of our international obligations. The initatives available to the Congress, whether manifested in new legislation, budget review, or program oversight, are varied and promising. Their enactment is contingent primarily upon a clear enunciation of need by governmetnal elements at all levels -- Federal, State and local -- and those private organizations whose products and services meet institutional and citizen requirements for a broad spectrum of STI...In summary, the essence of this study is to encapsulate and highlight past salient efforts and thinking about STI, and combine them with a perceptive view of its future roles and responsibilities.

The study delves into reasons why STI has become so important, stating:

> In examining the substance behind the facade of wizard machines, research and development programs, and responsive public laws one discovers information-- disciplinary information which supports the basic sciences -- technical, mission-oriented information which is the underpinning for major governmental programs -- and problem-oriented information which allows the lessening or solution of social and community dilemmas. STI is an all-pervasive, generally acknowledged, but little understood critical factor in contemporary life. When tied to a specific issue such as health care or alternative sources of power, the high-level decision maker can relate immediately to information in focus. After all. information has become much like the air we breathe and our faith in the future: it is omnipresent, accepted, relied upon, but seldom scrutinized too closely. The suggestion that this "resource" may deserve, even require, its own stated policies, infrastructure, and assignment of roles within the public and private sectors often leads to official uncertainty and a reluctance to change the status quo.

The study underscores the concern of Congress in the subject of STI over the years, and lists a number of public laws involving information that have been enacted in recent years. It also lists a number of the bills dealing with information being considered by the 95th Congress. Contemporary issues and the role of STI, multi-dimensional interests in the national STI resource, and the different classes of users who can satisfy different needs from the same STI national resource are analyzed with considerable economy of words. A chronology of significant STI events and landmark reports, covering the period from 1957 to 1978, is provided.Another section describing how

the scope of STI is broadening to include "societal" information is included. This is demonstrated in four role areas clarifying the role of STI in foreign policy, improving STI practices in government, using STI to alleviate national problems, and employing STI to advance U.S. scientific research and development.

Looking into the future, the study points out:

> Today, the United States stands on the threshold of an Information Age. How information is handled in this country will, to a large extent, determine our future. While the precise consequences of emerging information technology are poorly understood analytically, it is generally accepted that such technology is certain to have an important impact on the Nation's economic growth, social development, and its political standing in the world. America has the unique capability to store, retrieve and distribute information faster and with great facility to more people than ever before in our history. The present challenge is to formulate constructive national policies now that will protect our technological advantage and guide us to an ever increasing leadership position. It should be emphasized that both the international and domestic aspects of STI management and exchange are of equal importance. There are at least three ways to exercise this national responsibility: promote information science and technology, unite public and private sector STI programs, and improve the management of Federal STI programs.

The Congressional Research Service study team laid out a number of potential initiatives. Because these are important in understanding what Congress has done and needs to do, they are summarized as follows:

> Introduce <u>new legislation</u> that will require use of advanced management techniques and systems analysis for planning, monitoring, and evaluating STI activities; prescribe a minimal percentage of a contract or grant for ensuring satisfactory documentation; mandate employment of appropriate information tools and techniques; create a special information center, clearinghouse, or network to optimize the handling and dissemination of STI; suggest utilization of existing pertinent STI (governmental or private) resources and services; and identify, where necessary, present or potential public and private sector areas of responsibility and opportunity.
>
> <u>Existing legislation</u> could be reviewed during deliberation of budget, authorization, or appropriation committees in regard to: adequacy of public law goals and provisions from the vantage point of initial program performance; perceived effectiveness of present agency implementation, with particular attention to cost-performance measurement (where appropriate) and validity of project operational objectives; and possible value of high level executive branch (OMB) action to redirect departmental efforts (e.g., through issuance of an executive order).
>
> <u>"Jaw-boning" (persuasion) of key Federal executive branch components</u>: (OSTP, OMB, NTIA) to bring about improved STI organizational strength, planning, procedures, use of technology, multiple purpose files, and services to the community.
>
> <u>Analysis of sunset legislation</u> -- a cautionary but vital review of information resources and services which may be seriously diminished or com-

pletely lost. (The termination of the Science Information Council, National Science Foundation, might not have happened if it had been detected by the Congress when the Executive Branch did its sunset law housekeeping in the mid-1970s. (Author inserted.)

Utilization of legislative research and analysis capabilities. Congress can draw on the Congressional Research Service, Congressional Budget Office, Office of Technology Assessment, and the General Accounting Office to prepare in-depth studies on any aspect of STI activities.

The report concludes with the following recommendation:

> Congressional action is needed. Numerous studies over the past 20 years point to deficiencies in existing programs and the lack of policy guidance, and portend future problems. The executive branch has yet to assume full responsibility for the development of STI as a national resource. Congress has the opportunity to be the catalyst for achieving constructive change.

Regrettably, the strategy proposed by the study team was ignored, or if followed, to such a minor extent as to stimulate little action on the part of the Executive Branch. With the exception of what Congressman George E.Brown has done to focus attention on the need for better Federal STI programs and practices, the record is bleak. New legislation to solve the various problems and issues cited by the study group has not been forthcoming; existing legislation has received little attention by authorization and appropriation groups, "jawboning" of the Executive Branch of the President and the major R&D agencies has been absent, and there is little evidence that sunset law actions have received congressional attention. Another barrage of findings and recommendations resulted from the White House Conference on Libraries and Information Services undertaken by the National Commission on Libraries and Information Services in 1981. Little or no action has been taken to implement these by the Congress and the Federal agencies.

In connection with the White House Conference, the Congressional Research Service was called upon by Congressman Claiborne Pell,Chairman of the Subcommittee on Education, Arts and Humanities, to prepare a report on the role of library and information services in increasing international understanding and cooperation. On July 31, 1979, a pre-conference meeting was held at the State Department with 100 key individuals in attendance. This followed a planning meeting on international information

flows held at the National Academy of Sciences, on May 22, 1979, which was attended by about 40 experts. On March 17, 1980, Gilbert Gude, Director of CRS, sent a report to Congressman Pell, which was prepared by Robert Chartrand, Jane Bortnick, Jerry Borrell and reviewed by Walter A. Hahn and Richard T. Jerue, Associate Counsel for the Subcommittee.[1] The major work on the report was done by Robert Chartrand and Jane Bortnick.

The White House Conference on Libraries and Information Services examined five themes, the fifth of which dealt with Increasing International Understanding and Cooperation. The report addresses itself to the fifth theme exclusively. As the five-day White House Conference progressed, the report states:

> ...the importance of the international aspects of library and information services became quite evident, not only through prescribed program offerings but in the presentations by the Nation's leadership. In statements ranging from the philsosophical to the pragmatic, speakers conveyed the criticality of sustaining and improving this "national resource" and asked the delegates to come forward with their best thoughts on ways of ensuring the availability of vital information in the years ahead.

At the end of the Conference, delegates approved a total of 64 resolutions. In the international area four working groups made numerous proposals, such as: improving standards to facilitate international exchange; cooperative bibliographic projects; U.S. government involvement with other nations and international bodies be improved for information exchange programs; a U.S. clearinghouse be established so that library and information services could be better interfaced with foreign counterparts; networking programs be established for international exchange of information; continued action to enhance universal copyright protection; promotion of cultural, technological, educational, and trade information sharing, further support and assistance to developing countries for establishing information infrastructures; and encouragement of the media to carry more foreign information. Six resolutions dealing with

[1] United States Senate, International Information Exchange: Relevant Activities of the White House Conference on Library and Information Services, prepared for the Subcommittee on Education, Arts and the Humanities of the Committee on Labor and Human Resources, Committee Print, 96th Congress, June 22, 1980, pp 156.

international issues were selected and approved. Of these, two were approved in the general session: international information exchanges and Federal international communication and accountability. They addressed the need to establish and expand State and Federal programs to facilitate international information sharing and to improve coordination among the government agencies involved. Subsequently, four other resolutions were passed: international conference, center for international studies, establishment of an international youth library, and international copyright agreement.

Selected from his remarks at the pre-conference luncheon speech on international information exchange as expressing the thrust of the international theme, Thomas Pickering, Assistant Secretary of State, stated:

> The information age is greeted by all of us with expectancy and hope, but expectancy and hope that are tempered with concern that the opportunities of the information age should not be lost by failure to predict and take into account its consequences.Several issues involve fundamental values of morality and individual liberty, of national pride, and of national sovereignty which are factors in the regulation and control of information processing and exchange. These issues of the information age justify a strong national commitment to international discussion and open debate.

The recognition of the importance of international information exchange is not confined to one committee of Congress. On December 11, 1980, Congressman Jack Brooks. Chairman of the Committee on Government Operations, House of Representatives, submitted a report on International Information Flow: Forging a New Framework to the Committee of the Whole House on the State of the Union. [1] The study was undertaken by the Government Information and Individual Rights Subcommittee, chaired by Rep. Richardson Preyer. After a series of hearings and interviews, together with extensive documentation research and analysis performed by the committee staff and/Jane Bortnick of the Congressional Research Service, Library of Congress, a report was prepared. The principal findings of the

[1] U.S. Congress, International Information Flow: Forging a New Framework,32nd Report by the Committee on Government Operations together with Additional views, 96th Congress, 2d session, House Report No. 95-1535, Union Calendar No. 905, December 11, 1980, pp 61.

report are relatively familiar. They are summarized as follows:

> Substantial barriers hinder the international flow through telecommunication systems. The barriers are expected to increase...Most national governments recognize the importance for their societies and economies of the changes in the flow of information brought about by changes in the flow of information brought about by advances in information technology. Some of these countries are planning for the future...Barriers damage the economic,social, and political structure of all countries, including the United States,..The U.S. government lacks a coordinated policy regarding barriers to international flow... Such policy elements that do exist are incomplete and ad hoc...Responsibility and authority to develop policy is divided, thus conflicting and confusing. Where policy authority or coordinating responsibility is asserted, effective steps to employ that authority or to coordinate government activities have not been taken...Mechanisms for implementing policy remain largely untested...To develop and implement a coherent policy, an effective coordinating mechanism is needed.

Fourteen recommendations have been prepared to cope with the need. In summary, they call for a Council on International Communications and Information to coordinate the development and implementation of a uniform, comprehensive U.S. policy. It would be chaired by an independent director, Secretary of State, Secretary of Commerce, Chairman of the Federal Communications Commission, the U.S. Trade Representative, the Director of OMB, and the Assistant to the President for National Security Affairs. There would be an advisory committee and an interagency committee to advise the Council. Periodic reports to Congress would be required. A special study and report to Congress would be undertaken regarding additional legislative or administrative changes that are needed. Within the Department of State, a Bureau of International Communications and Information would be established.There would also be a Special Ambassador for Telecommunications and Information Services appointed in the Office of the U.S. Trade Representative. In FCC, an Office of International Communications should be established within the Common Carrier Bureau, but operate separately from it. Resources would be provided to the Council, and in the Department of State and FCC, existing resources would be allocated to support the new functions.

The report goes into detail on the above. It also discusses what is transpiring in other countries, and how the U.S. is reacting to barriers being erected by other countries. Also discussed are the pros and cons of formulating a national information policy.

The continuing concern of Congress in information technology and its potential was exhibited in a number of hearings held on information technology and education in 1980. With the help of the Congressional Research Service, Library of Congress, a report was prepared for the Committee on Science and Technology, U.S. House of Representatives entitled Information Technology in Education: Perspectives and Potentials.[1] Two sets of recommendations were made, which are summarized as follows:

Recommendations for Immediate Actions:

> An implementation plan for Federal coordination and support of instructional uses of information technology should be prepared. The Director of the Office of Science and Technology Policy should convene a Task Force composed of a Coordinating Group, manned by representatives from interagency committees and involved agencies,and an Advisory Committee made up of representatives from the private sector involved in technology and education. The Task Force would be called upon to develop an objective-based implementation plan that would feature specific objectives based on identified needs for Federal coordination, coordination strategies, timeframes, and resource requirements, roles for principal Federal agencies, appropriate areas for cooperative interagency programs, feasible options needed to aid or supplant existing mechanisms, and an examination of existing legislative authorities and needed modifications.

Recommendations for the Long Range Needs:

> Federal support of R&D in information science and technology; long term support will require that Congress make its authorization process sufficiently flexible to permit reasonable guarantees of continuing work; both the Congress and the Executive Branch should begin to anticipate and to plan for the significant impacts on educational, political, and social institutions that may result from the widespread use of information technology in education and elsewhere.

The report shows that the Subcommittee on Science, Reserach and Technology was aware that the use of information technology had great potential for other fields as well as in science and technology itself. The Subcommittee was joined by the Committee on Education and Labor, U.S. House of Representatives,in a concluding statement that reveals the continuing concern of Congress. What it says is particularly important in light of renewed interest of both the Congress and the Executive Branch in national educational problems. Here is an excerpt:

[1] U.S. House of Representatives, Information Technology in Education: Perspectives and Potentials, Committee Print, Report prepared for the Subcommittee on Science, Research and Technology, Committee on Science and Technology, 2nd Session, by the Congressional Research Service, Library of Congress, December 1980,pp 183.

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> There is a tremendous amount of effort being directed, in all sectors and at all levels, at the uses of information technology in education. The need to coordinate and to help direct this effort is urgent. Although education in the United States is largely a state and local responsibility, the high costs associated with hardware and software development make it unlikely that substantial progress can be made without a continuing high level of involvement by the Federal government. The need to equalize opportunity and the potential gains in productivity that a technologically skilled workforce could provide, argue for renewed commitment by the Federal government. The Subcommittees urge that such a commitment be made.

Unlike the scientific and technical information area, response was rapid by the Secretary of Education. He created a Department-wide Task Force on Learning and Electronic Technologies, chaired by an Assistant Secretary of Educational Research and Improvement, to get on with the job, an action that must have been gratifying to both House Committees. But not all members of Congress were happy about the way the Federal agencies were coping with new information technology and the management of information processes.

Congressman Jack Brooks, talking at the 1981 Federal Office Systems Exposition on the topic of Information Management for the 80's minced no words when he said: [1]

> I have long held the view that information technology is the single most important way for the government to increase services while at the same time reducing the cost of government to our citizens. The Paperwork Commission and other Presidential and Congressional studies have shown that there is increasing concern about the way the government collects, uses and distributes information,,, (including) the reluctance by top officials in the government to change their way of doing business. The studies found that the Federal government is heavily and irreversably dependent upon effective application of information technology. Effective use of information technology can be a major force in the fight against inflation. It can increase productivity and performance, improve the delivery of services to the citizenry, and increase our nation's economic and military strength. Despite the tremendous benefits that can be obtained, the government has failed effectively to use information technology. While the government was an early leader in the use of this technology, it began to fall behind in the early 1970s, in fact, throughout the 1970s, one can see an accelerating deterioration in the government's management and use of these resources. The lack of a strong, central leadership is the primary cause of this rapid deterioration in the government's ability to exploit and benefit from information technology.

Undoubtedly, the House Science and Technology would join the Chairman of the House

[1] Brooks, Jack, from his Keynote Address at the Information Management for the '80s Exposotion, held in Washington, D.C., August 1981.

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Government Operations Committee in his analysis and point out that the indictment also includes the way Federal agency and Executive Office of the President officials have mishandled the Federal STI effort and how it, too, began to fall behind in the early 1970s. The lack of strong, central leadership in the STI area was also a problem, one that has not been solved more than a decade later.

In 1980, another report was prepared, dealing with Federal information management. The author was Louise Giovane Becker, an analyst in information sciences, located in the Science Policy Research Division, Congressional Research Service. [1] The report provides "an overview of a wide range of problems associated with Federal information management policy." Included among the issues are those involving: Federal reporting requriements processes, information management policies, acquisition and procurement of information technology, and the emergence of a new management approach - information resources management. It is a useful document which goes into detail on problems, issues, legislation, initiatives of the Congress and the Executive Branch, listing of government-wide policiesl and directives, and what the concept of informationa resources management is and holds in store. While the report does not contain a list of recommendations, it does discuss new directions and measures for the future. The reader will find it a valuable document because of what it contains especially in depicting the thrust for overall information management as contrasted with the piecemeal approach in vogue in the Federal agencies.

[1] Becker, Louise Giovane, Federal Information Management Policy: Critical Directions, Report No. 80 - 143 SPR, Congressional Research Service, Library of Congress, June 30, 1980, pp 179.

In 1981, the House Subcommittee on Science, Research and Technology held two days of hearings on May 27 and 28, 1971, chaired by Rep. Doug Walgren, its chairman. The subject of the hearings was the Information Science and Technology Act. A report was prepared by Jane Bortnick, Specialist in Information Science and Technology, Science Policy Research Division for the Subcommittee, entitled Analysis of Hearings on H.R. 3137: The Information and Technology Act. [1] As described by the Director of the Legislative Research Service, Gilbert Gude, in his letter of transmittal, the report:

> ...provides an analysis of the major issues discussed at the subcommittee's hearings on H.R. 3137 and outlines the various alternatives for action proposed by the witnesses...(Also included is) an overview of the impact of information technology on society, a description of the U.S. Government's framework for information policy issues, discussion of the provisions of H.R. 3137, and various alternative courses of action.

In turn, Representative Doug Walgren sent the report to the chairman of the House Committee on Science and Technology, stating that the Subcommittee:

> believes that this report provides a useful analysis of the need to establish effective mechanisms for government-private sector cooperation which is essential for maintaining United States leadership in world information markets and for maximizing the potential benefits of microelectronics and communications technology.

He also stated that the report contains conclusions and recommendations of the Subcommittee on Science, Research and Technology approved by its members.

Based on the hearings and other inputs, the Subcommittee concluded that the Federal government is having a difficult time dev eloping a coherent view of how our tansition to an information society should take place. There is no consensus on the proper scope of a national information policy. The government is inclined to defer to the marketplace in information activities. Interaction between the public and private information sectors is fuzzy and so is the boundaries between them. The Federal government is deeply involved in a large variety of information activities in R&D and other areas, hence the sole rennliance on the decentralized approach brings three major problems:

[1] U.S. Congress, Analysis of Hearings on H.R. 3137: The Information Science and Technology Act, Report prepared by the Congressional Research Service, Library of Congress for the Subcommittee on Science, Research and Technology, Transmitted to the Committee on Science and Technology, U.S. House of Representatives, Committee Print, Washington, D.C., June 1982, pp 61.

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1. Lack of coordination among agencies charged with information responsibilities and between public and private sectors.

2. Inadequate attention at high levels to the broad changes in many economic, technical and social sectors which may be triggered by information technology.

3. Lack of investment of human or financial resources to ihsure that our Nation makes best use of new technological developments both domestically and in our competitive trade position.

To solve these problems, the Subcommittee recommends:

1. Establishment in the Executive Office of the President of an interdisciplinary Task Force on Information Science and Technology, to be chaired by the Director of OSTP and to include the participation of the Associate Administrator of OMB for Information and Regulatory Affairs.

2. Establishment of a high-level Advisory Board to the Task Force, composed of experts drawn from both public and private sectors and representing the variety of diffeent functions involved in information processing and transfer. The Board would function under a congressional charter for five years. It would provide technical and policy advice on issues of immediate and long-range concern, and would act as an interface between governmental planning and policy formation and private sector activities.

3. Immediate action on the part of OSTP to work with OMB to take immediate steps to improve the dissemination of STI generated by the Federal government including: better coordination of STI activities among the agencies; elimination of institutional barriers to improve STI flows; integration of data bases and elimination of unnecessary duplication through increased networking capabiliities; the appropriate blending of private sector capabilities with Federal efforts; and reconstituting an active, permanent interagency committee to deal with STI issues.

The bill was not passed, unfortunately, nor did the Director of OSTP take actions along the lines recommended in the report of hearings. In a letter signed by Representative George E. Brown and Doug Walgren to a number of information experts and scientists interested in communications on January 4, 1983, a copy of the hearing report was included. The content of the letter is amazing. After stating that:

> The key point of this report is the finding by the Subcommittee of serious weaknesses in our national response to the challenge posed by the rapid development of information technology. The lack of a coherent strategy limits our ability to exploit the progress of the Information Revolution for our economic and social benefit.

the authors do a turnabout and write:

> Although the Subcommittee believes that the Federal Government has an important role to play in developing a consensus for action on information issues, it clearly recognizes the unique and essential function of commercial and not-for-profit enterprises in planning and implementing informa

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> tion policies. A central feature of the hearings and other observations of our colleagues has been a paradox in concerns for forming a more coherent national strategy. Most feel that the magnitude of coming technical and related institutional change and opportunities argue the need for a more seriously thought-out approach to the future. On the other hand, in the current climate of restraint in federal budget and organization, many feel it is not feasible to envision an entity within the Federal Government as providing leadership in developing options for that approach. (Underlining added by author)

The Congressmen then develop the theme that there should be an effort sponsored by private interests with the government acting as a participant only in the development of a national strategy. The letter then invites suggestions from those who received it concerning how to initiate and promote a cooperative forum for the discussion of information policy issues. The frustration that the two Congressmen have experienced is justified; OSTP has been adament in its refusal to cooperate and follow the spirit of its own enabling legislation. But the notion that the problem is the lack of funds and personnel in OSTP is questionable. In the early 1960s, when the Office of Science and Technology decided to provide leadership in this area, it provided only one space for the purpose. Two or three other information experts were borrowed from the Department of Defense and other agencies to man the program. Insofar as funds are concerned, several hundred million dollars are being spent on the Federal STI program annually. The cost of one or two persons to manage and coordinate the overall program is relatively infinitesimal. As long as Congress controls the funds, it is in the driver's seat. The climate that was current in the early 1960s was even more hostile to the upgrading of Federal STI programs than exists today, yet Senator Hubert Humphrey was able to accomplish it in the Executive Office of the President and the key Federal R&D agencies. This was before, it should be pointed out, there was general acceptance of the arrival of a new Information Age.

In summary, Congress, among the Branches of the United States Government, has been the most visionary in seeking to improve Federal information programs. This is clearly demonstrated in the number of bills, hearings and other actions reported in this section. The criticism in the previous chapter is stimulated by the fear that Congress' resolve is weakening somehow. There are two issues that should not be mixed up. First, the United States needs to create the kind of strategies and actions that will ensure its world

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leadership role in STI matters. Second, the Federal government should upgrade its own STI programs in anticipation of growing needs to make its science and technology program more productive and more competitive. The latter program demands an internal effort that will be described in the last chapter. There should not be an expectation that a forum based in the private sector is needed to stimulate action by the leaders in the Federal Branch. The key that Congress can turn is a demand that laws be implemented and missions accomplished by the agencies. The sadness is that virtually all of the Federal agency leaders, including the key R&D managers, are unaware of the continuing concern of Congress about the health of Federal STI programs. Communication in this area has been between Representatives George Brown and Doug Walgren and OSTP officials for the most part, not with the agency leadership. This needs to be changed. Congress should undertake:

Policy hearings with top Federal agency leadership to make sure that they are aware of the need for strong STI programs and Congress' oft-expressed concern for better organization and management of Federal STI programs in each agency.

Federal STI stewardship review hearings. The principals would be the agency's top R&D and STI managers, reporting on the stewardship of their STI programs, including plans for the future. They would also disclose their funding and other resource applications, an account of the services they are providing, a description of their users, coordination undertaken within and outside of the agency, and problems and issues that they face.

Indoctrination of congressional appropriation and authorization committees with the kinds of questions and backup materials that such groups could use during budget hearings to impress on agency leaders the need for strong and effective STI programs and management.

The organization of an annual hearing to provide an opportunity for a forum which will make it possible to discuss Federal, public-private sector, international and related issues by "name" guests and concerned stakeholders and citizens.

A review by the Congressional Research Service and the Office of Technology Assessment (and other groups) of the many STI reports generated by Congress and the Executive Branch to determine what kind of recommendations are still relevant and what kind of an apparatus is needed to ensure action to improve Federal and national STI in the future.